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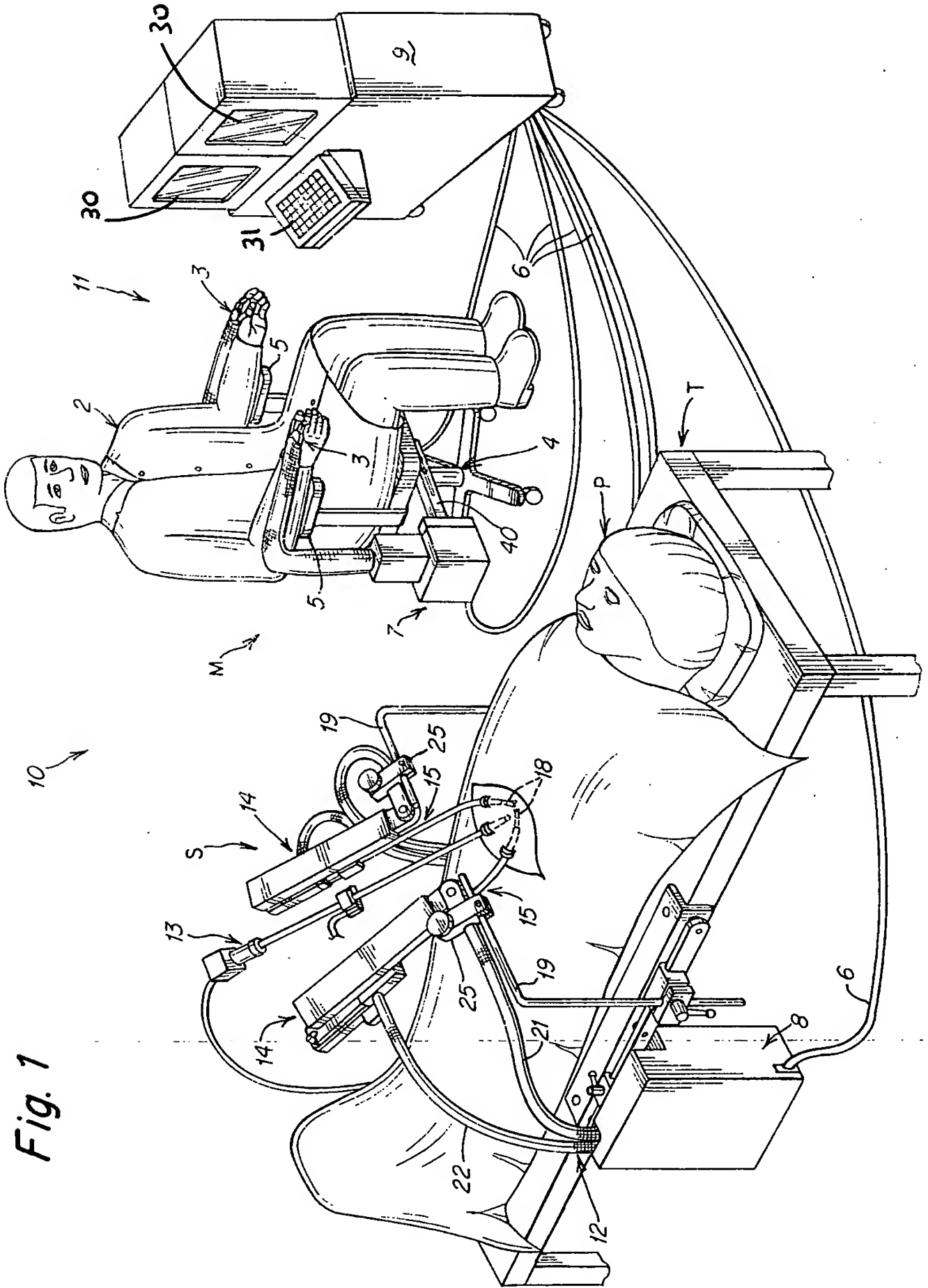
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Fig. 1



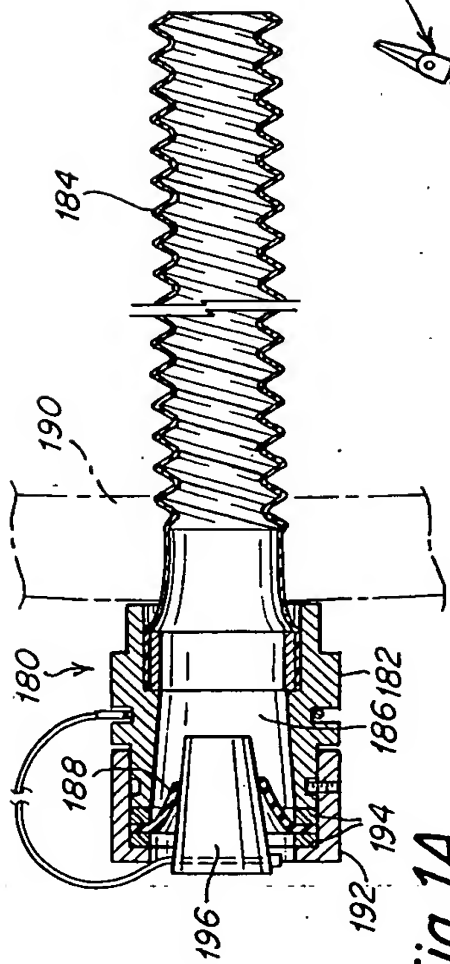


Fig. 1A

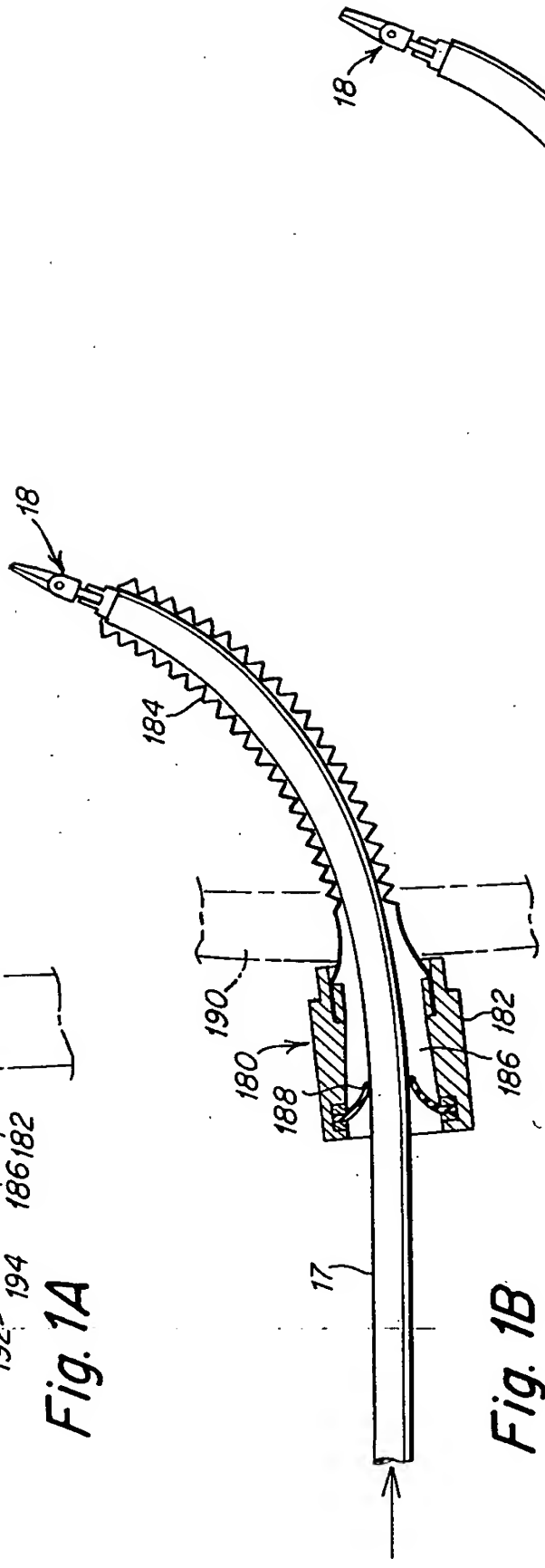


Fig. 1B

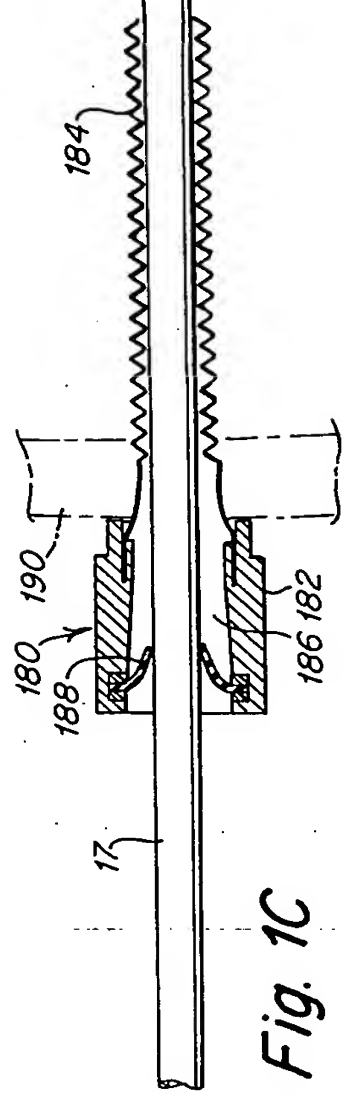


Fig. 1C

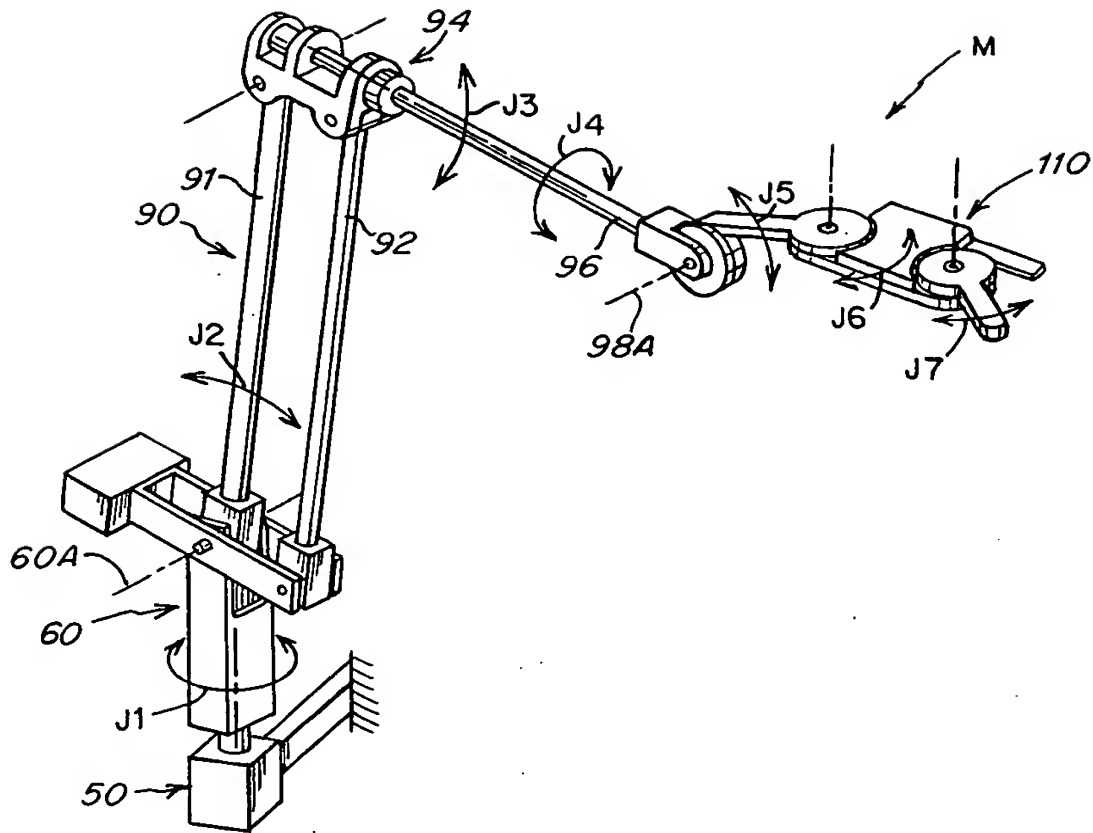


Fig. 2A

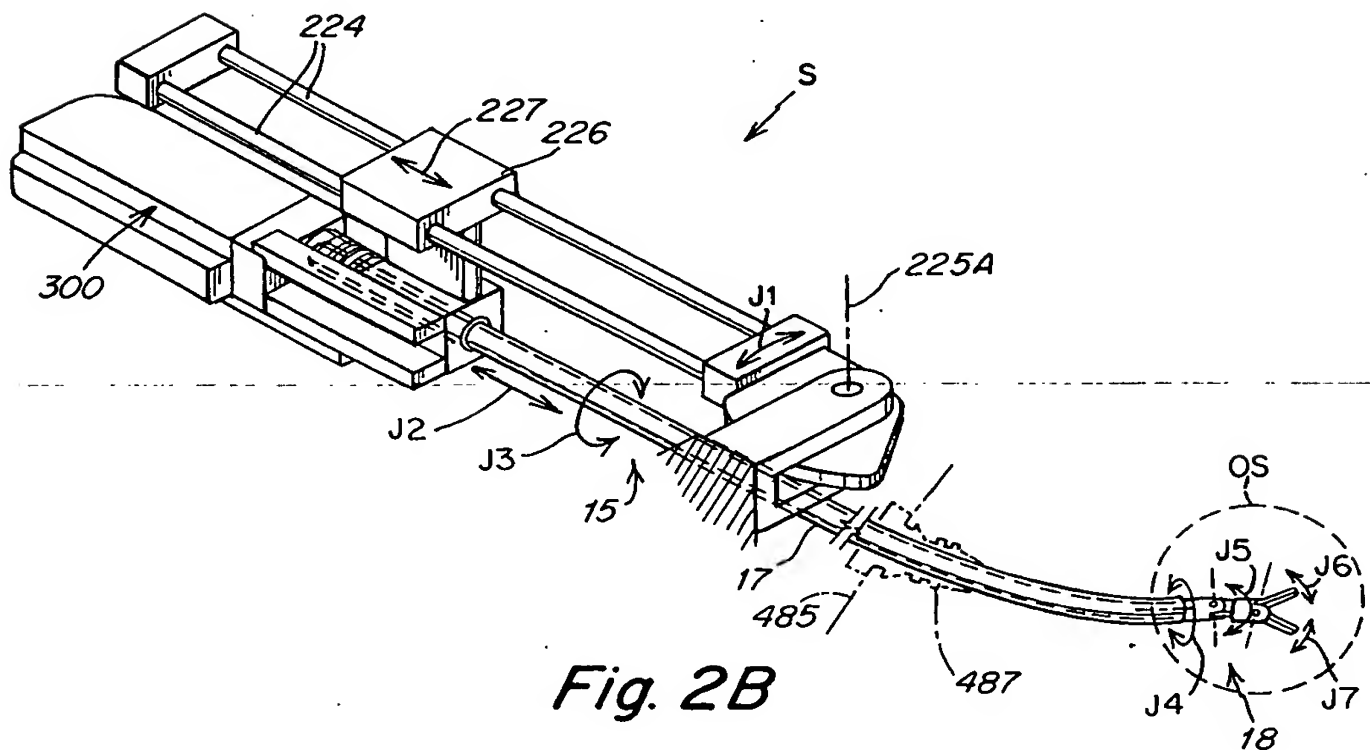


Fig. 2B

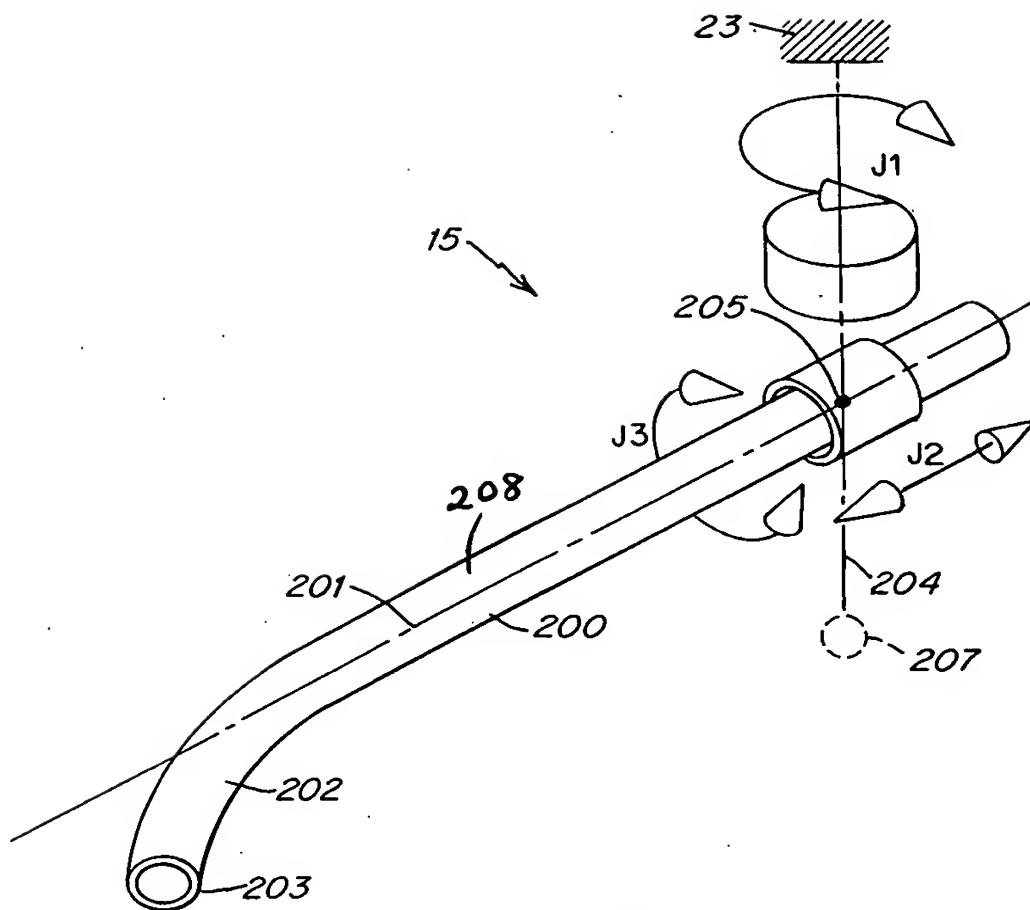


Fig. 2C

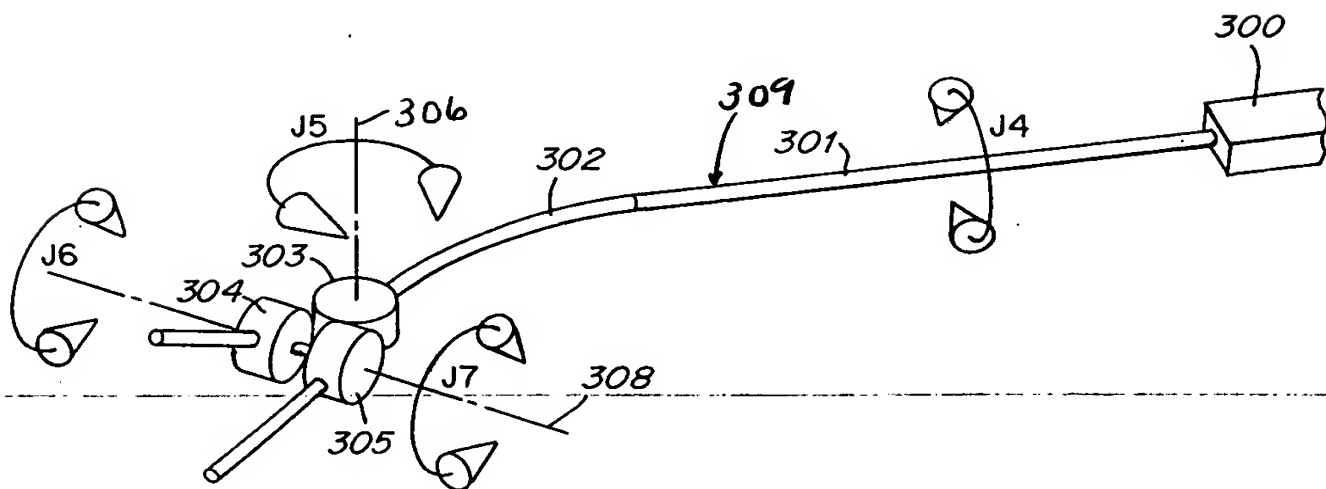


Fig. 2D

*Fig. 3*

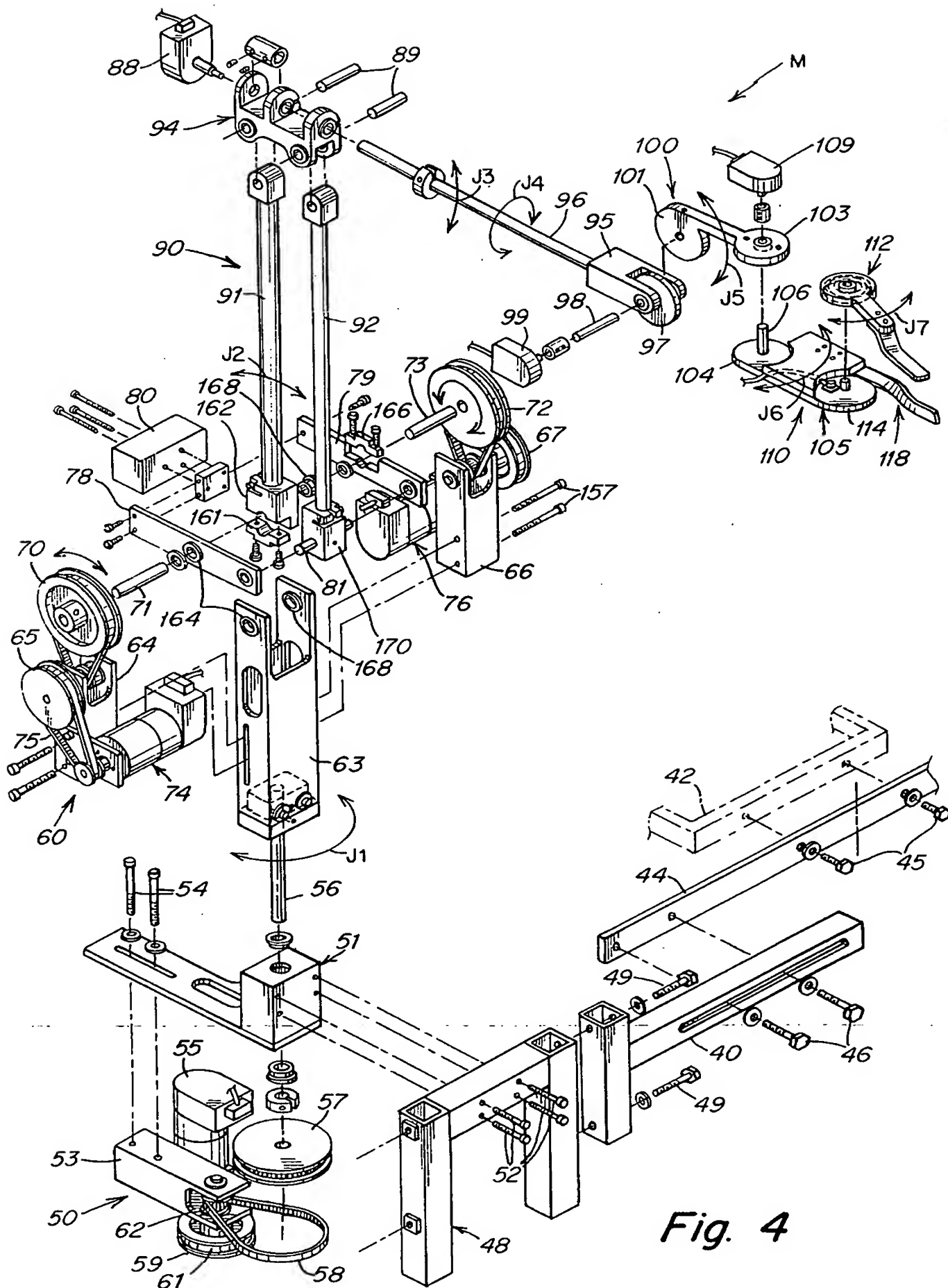


Fig. 4

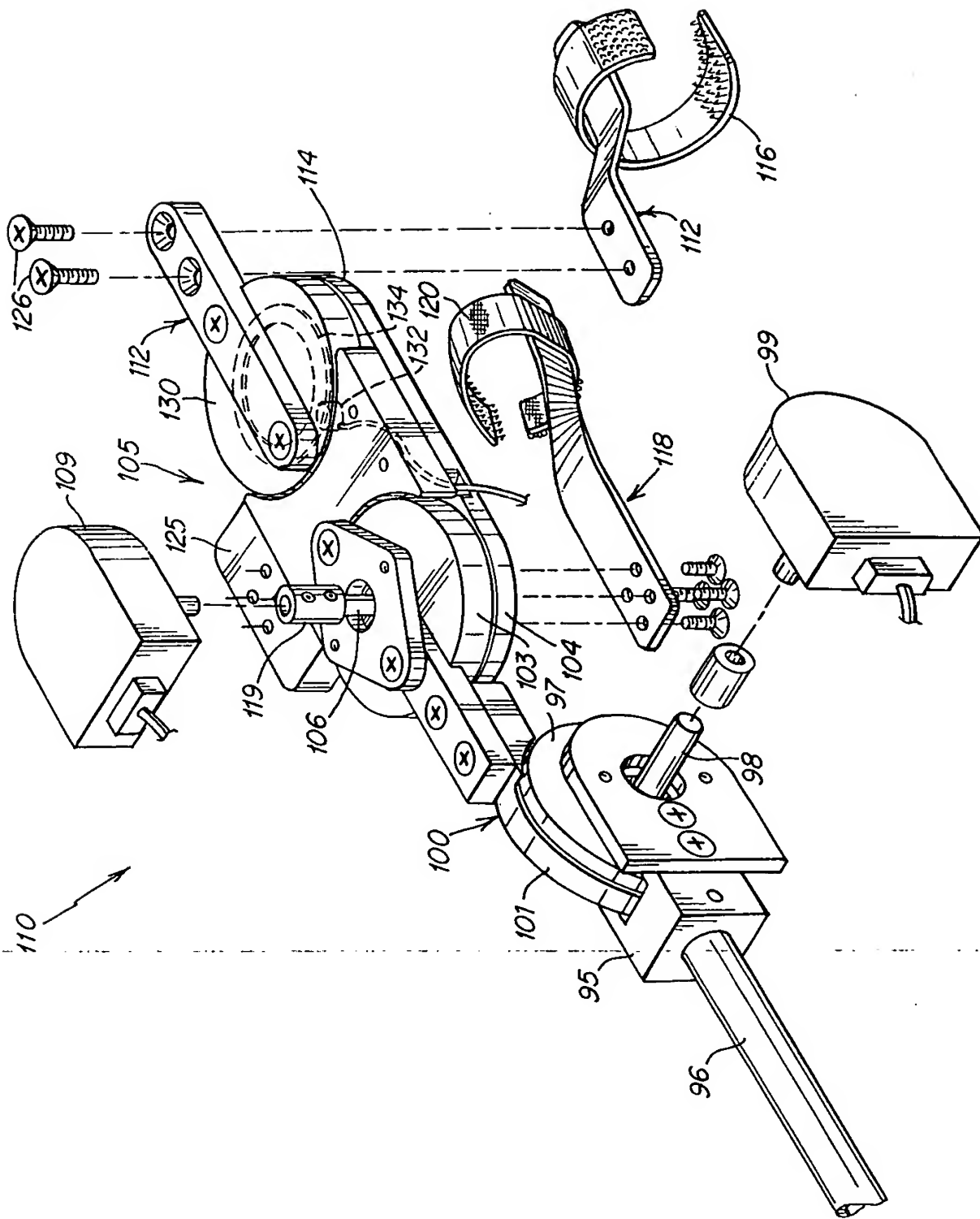


Fig. 5



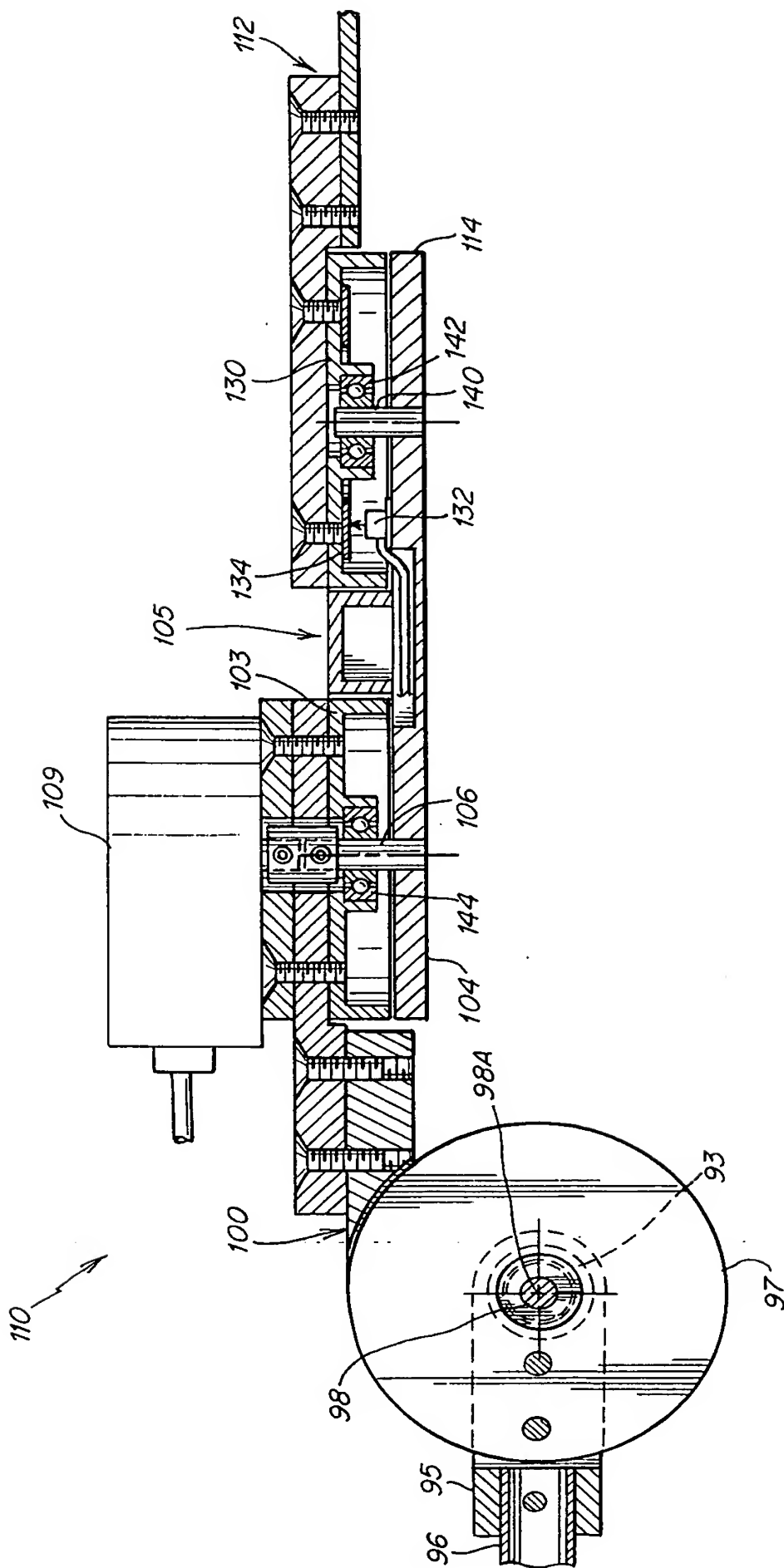


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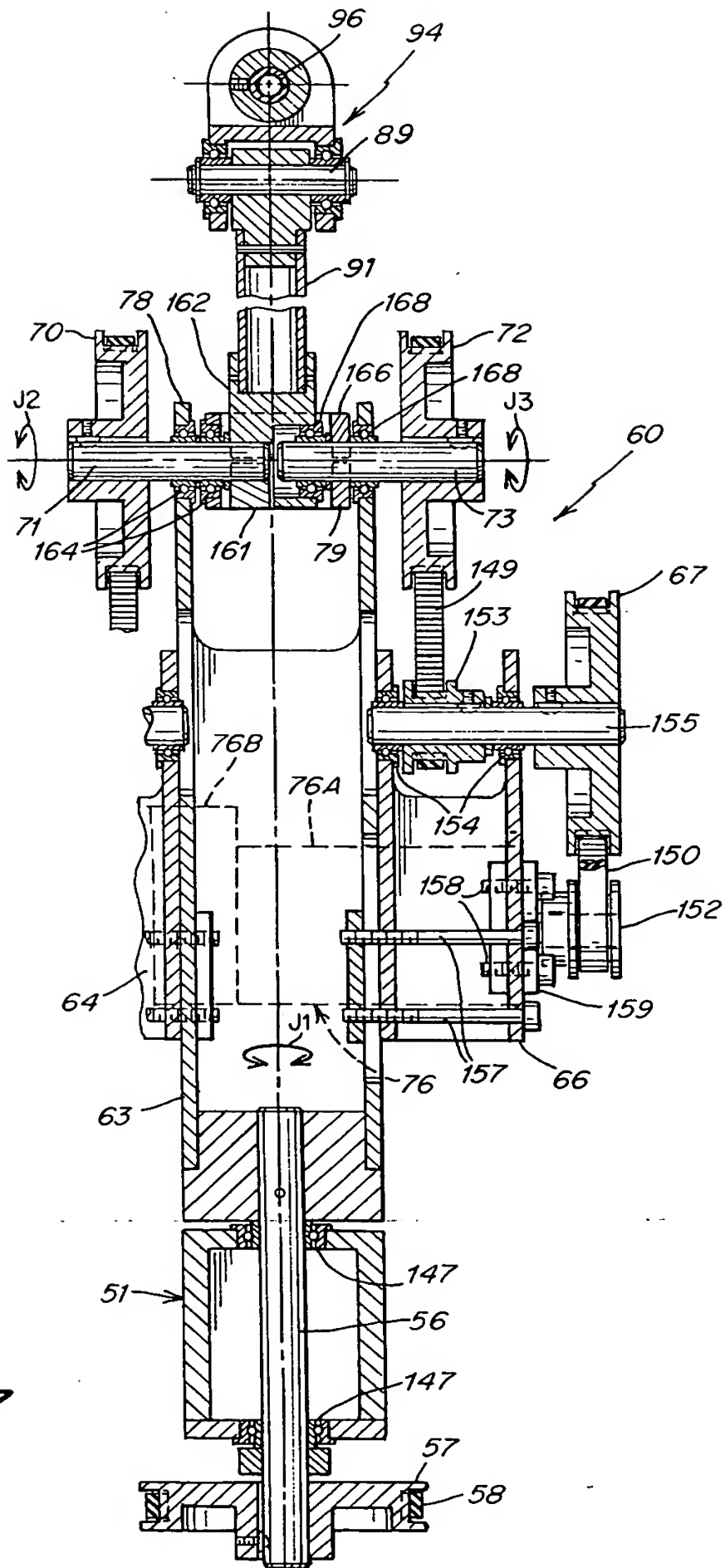


Fig. 7

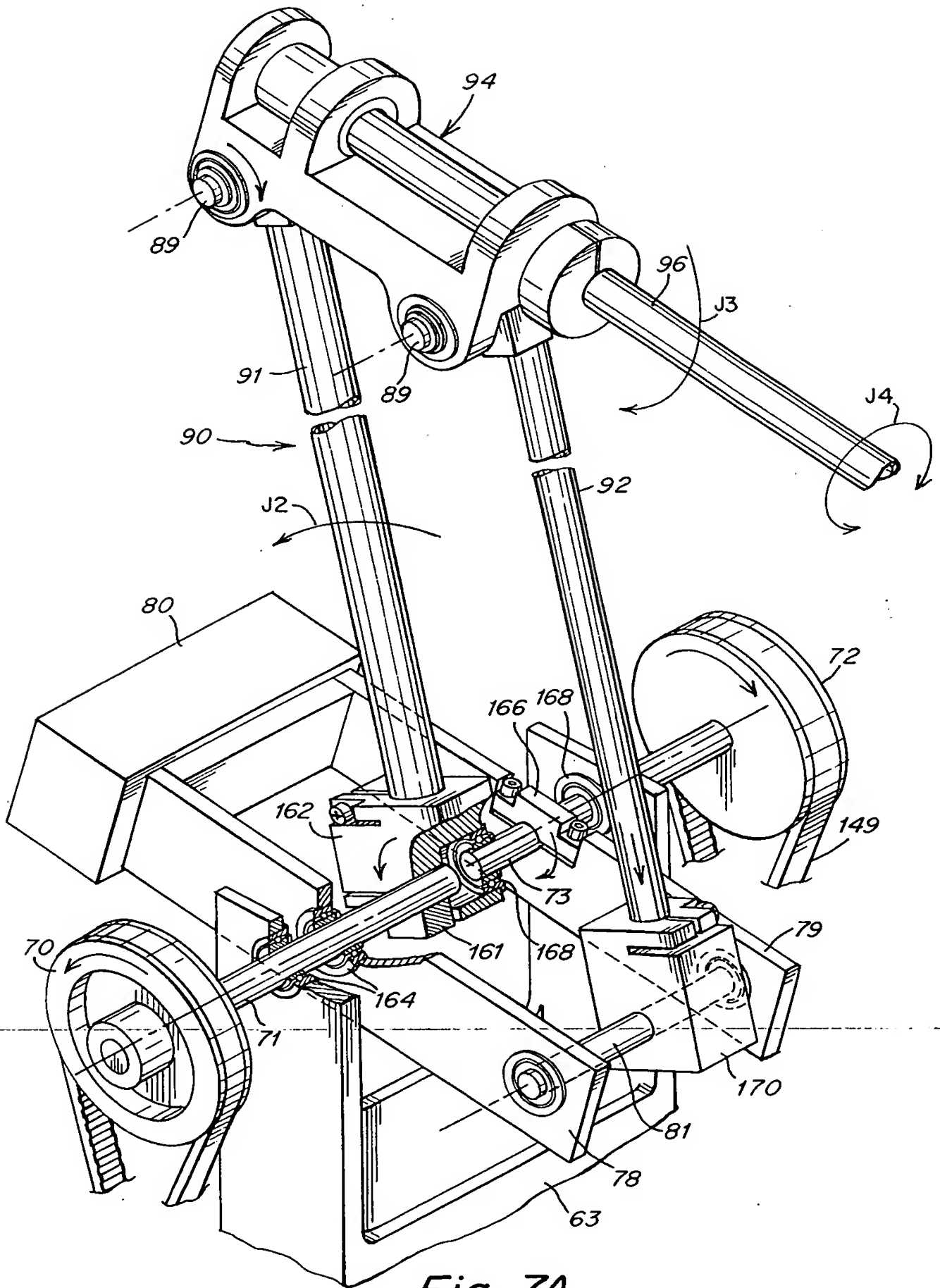


Fig. 7A

*Fig. 8*

FIG. 8B

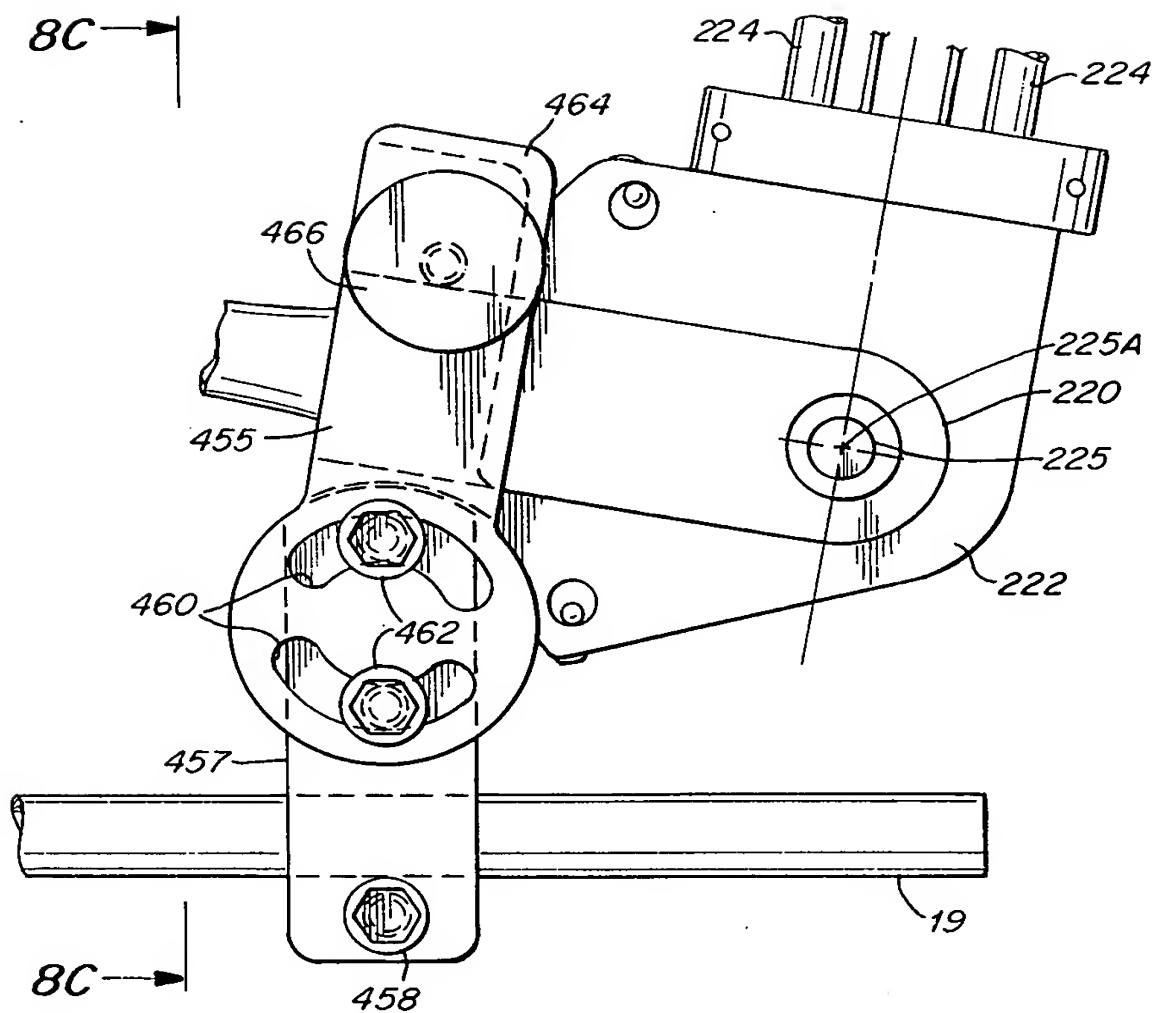


Fig. 8B

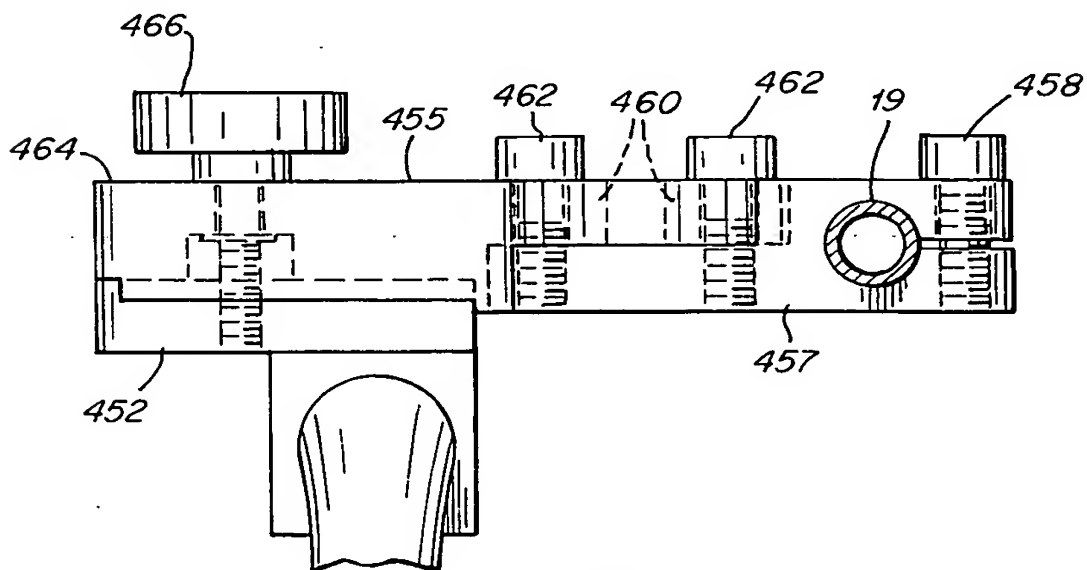


Fig. 8C

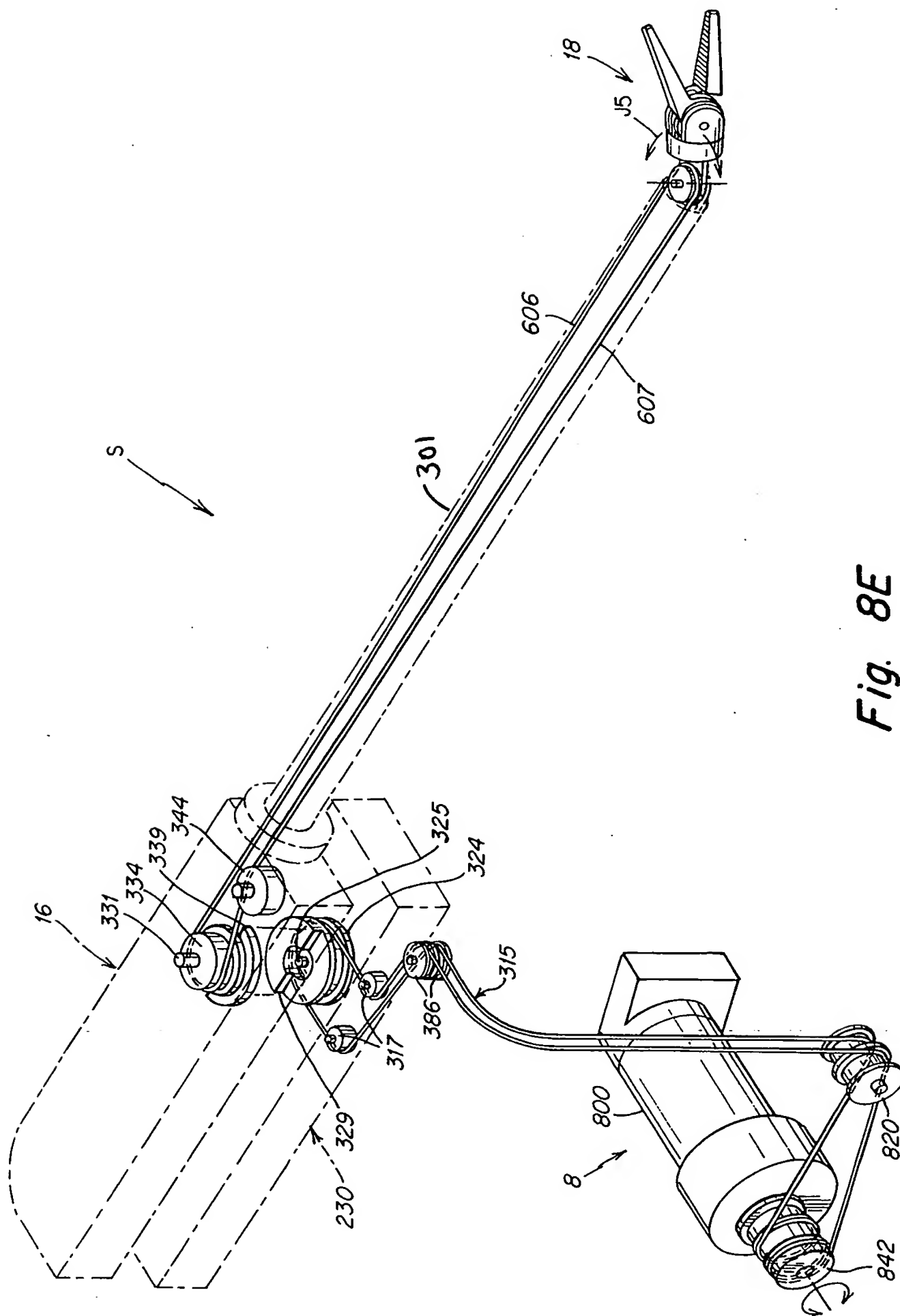
[illegible]

Fig. 8E

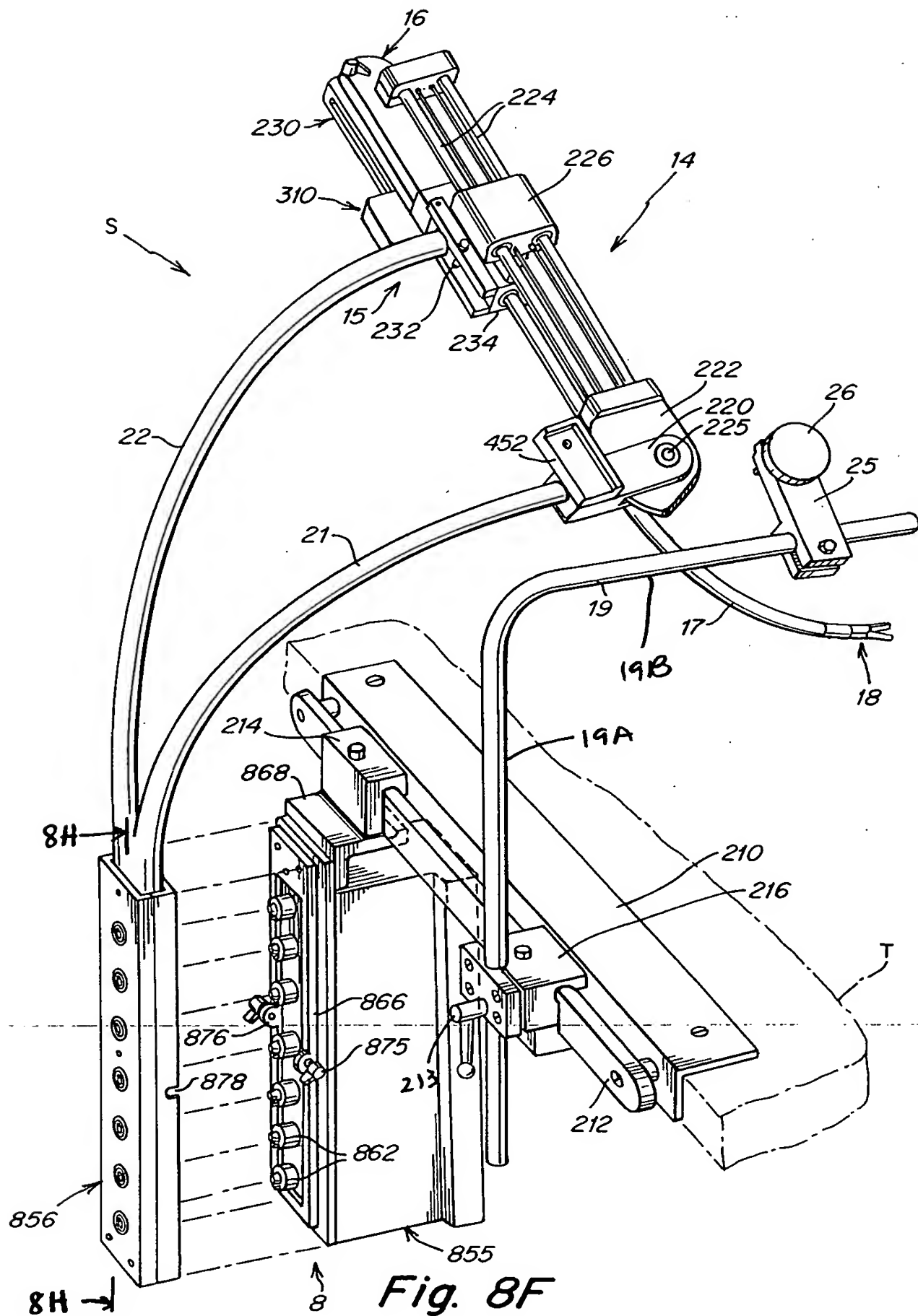


Fig. 8F

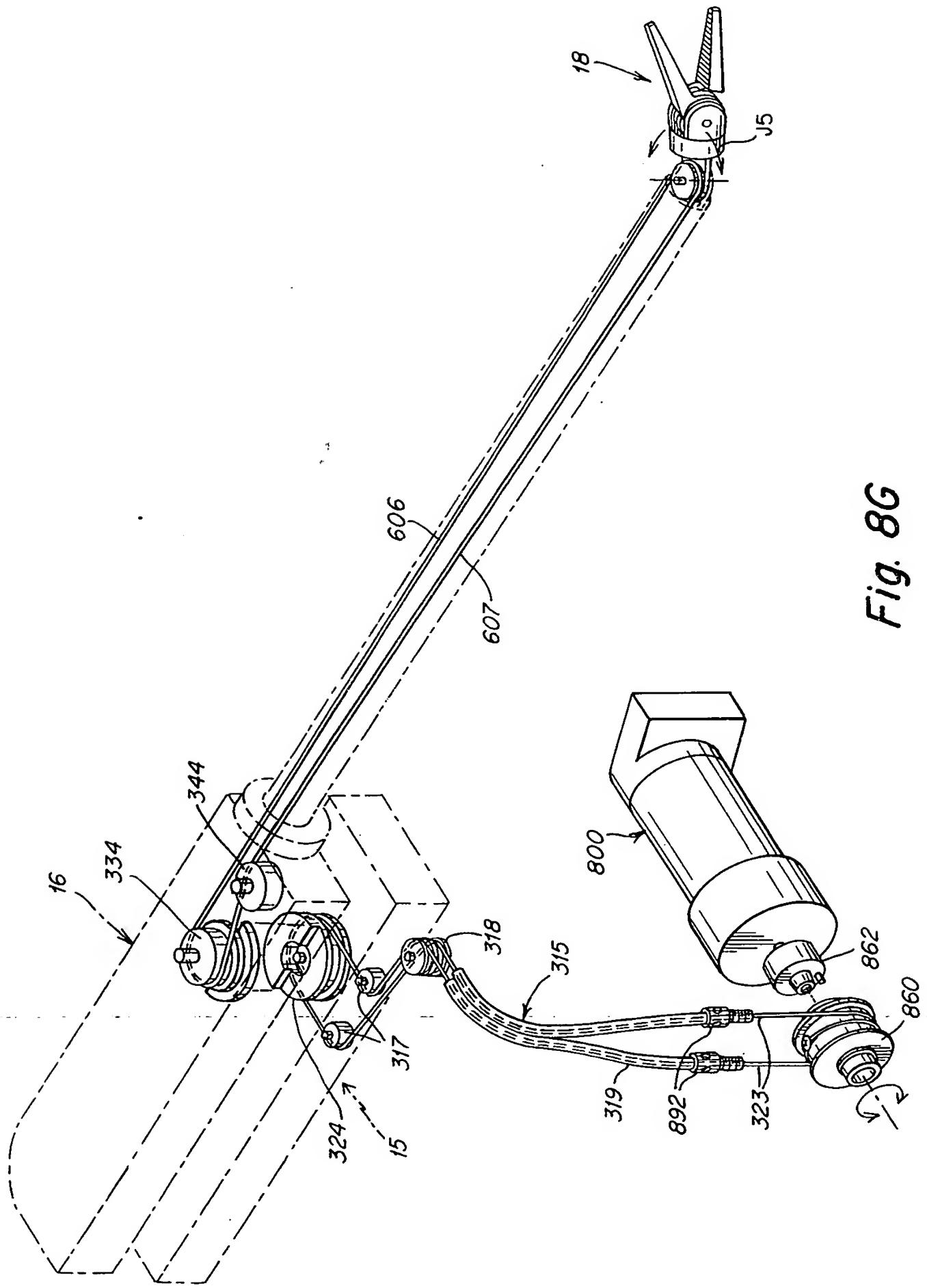


Fig. 8G



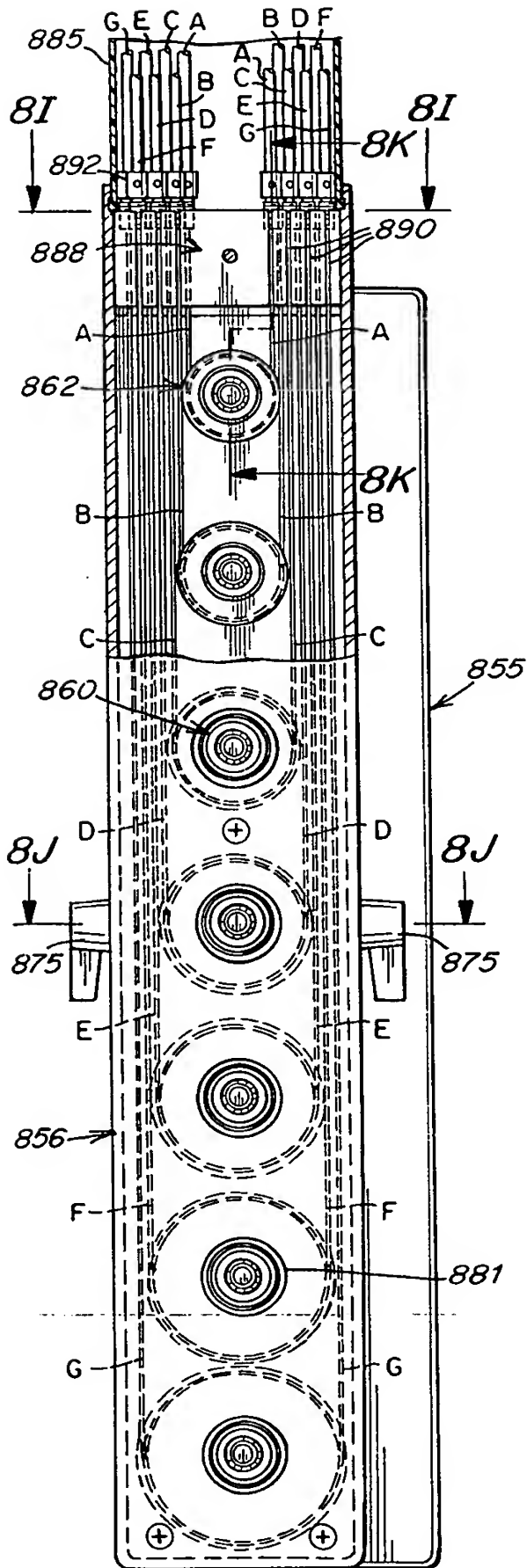


Fig. 8H

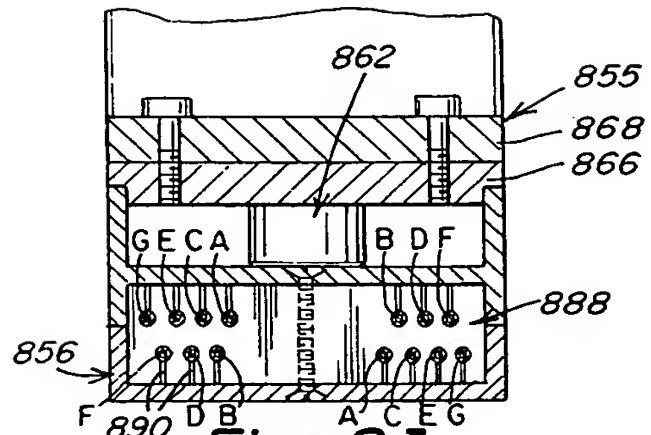


Fig. 8I

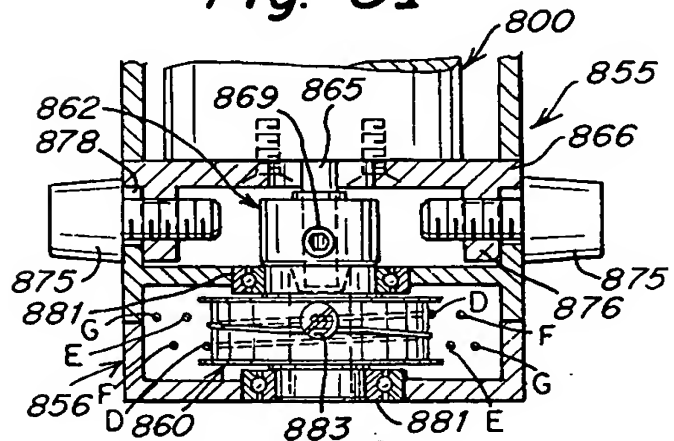


Fig. 8J

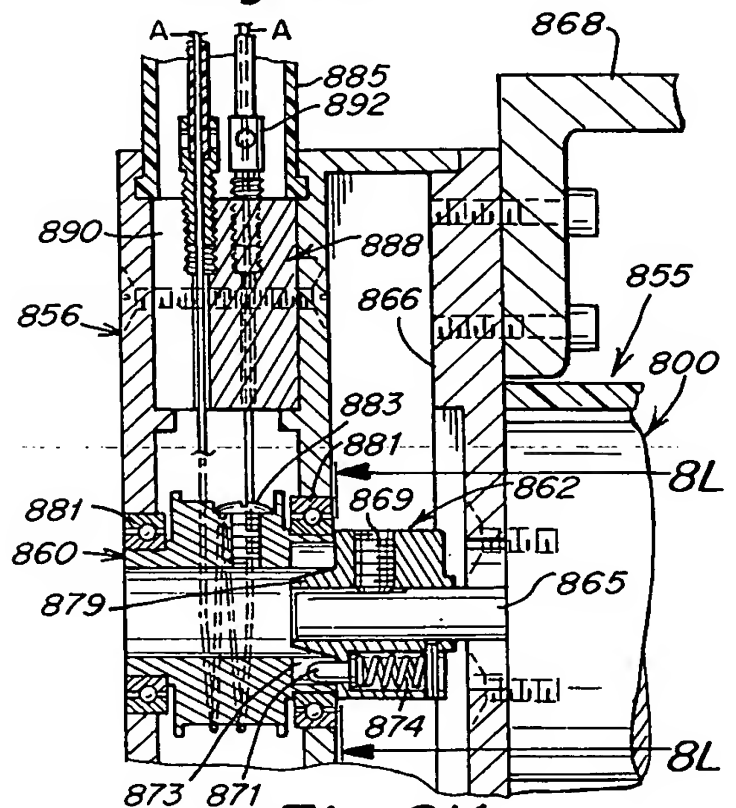


Fig. 8K



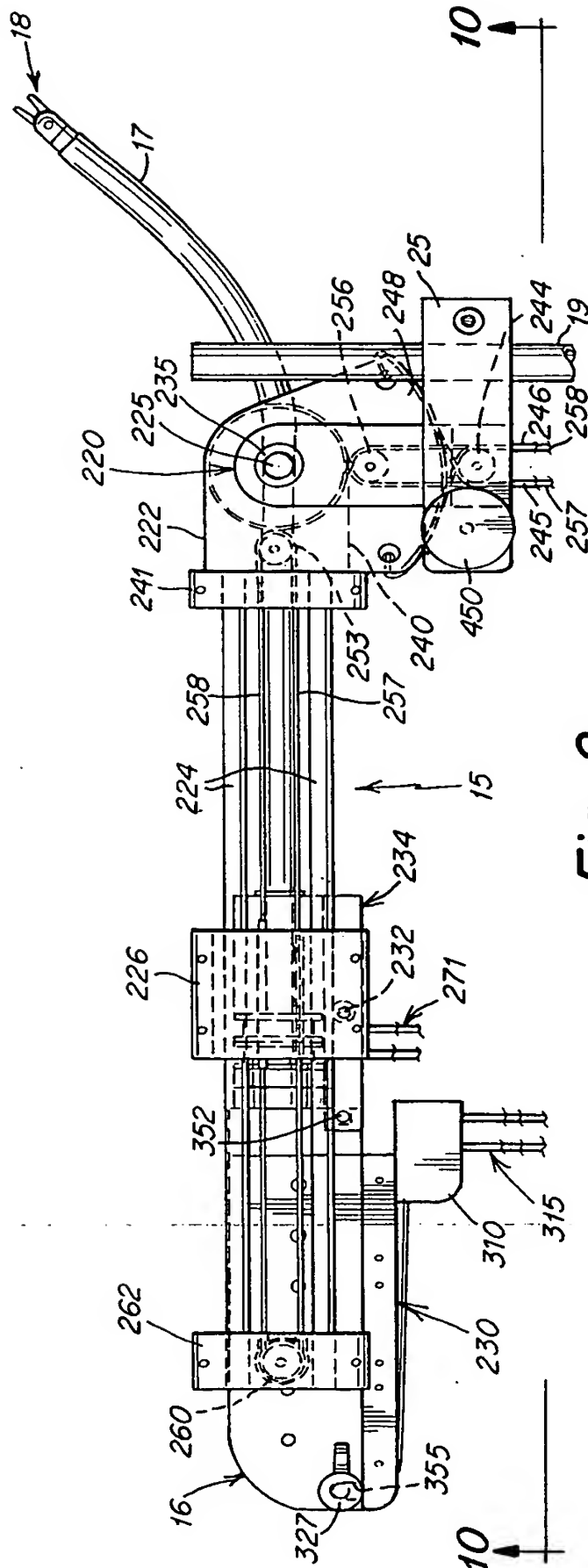


Fig. 9

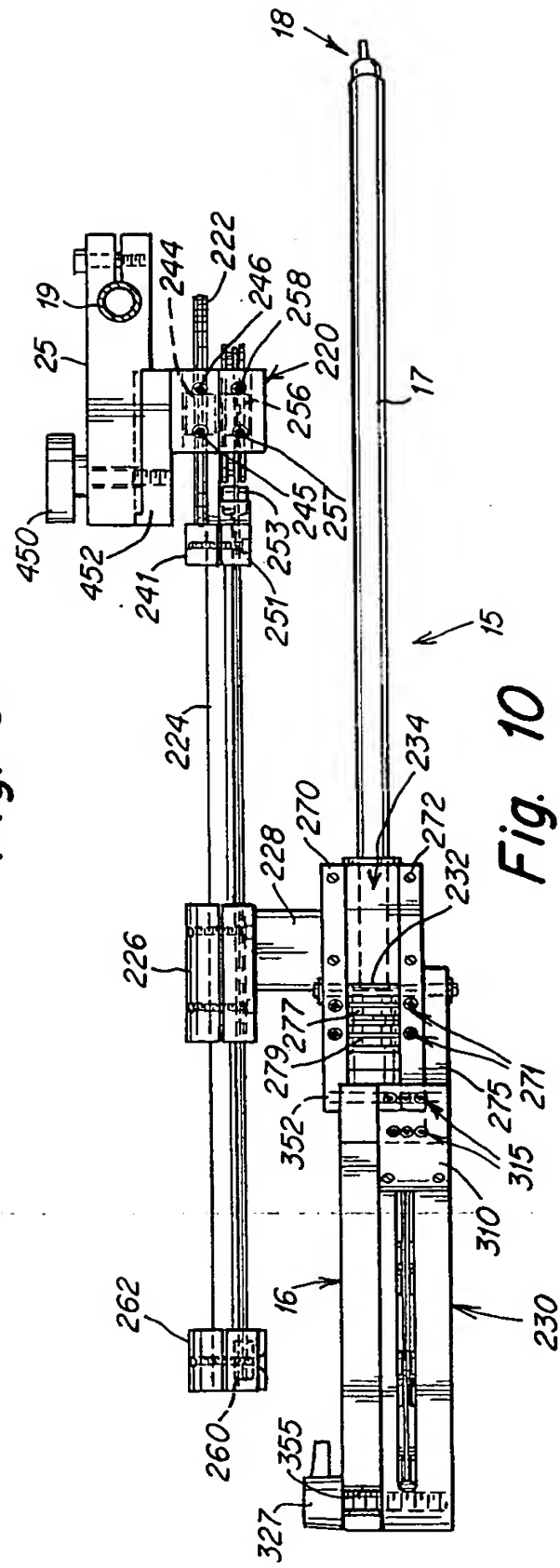


Fig. 10

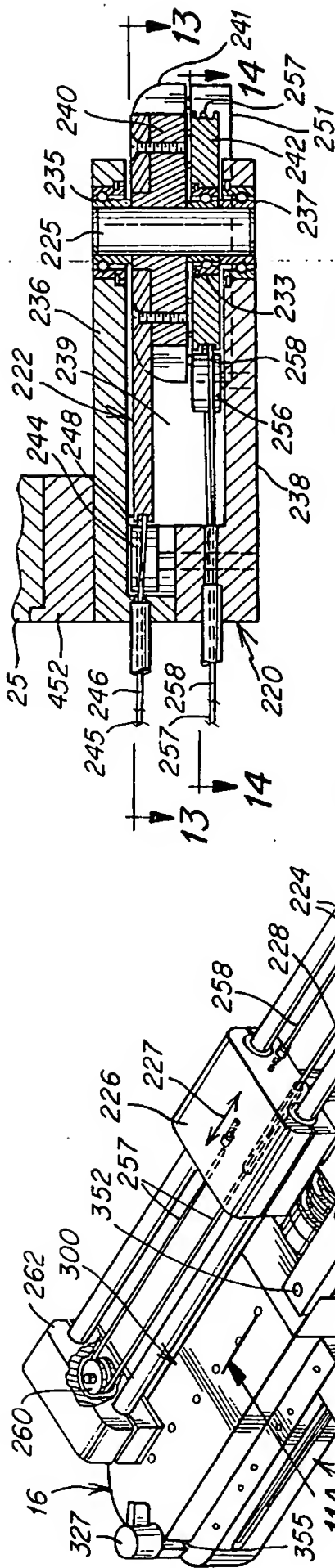


Fig. 12

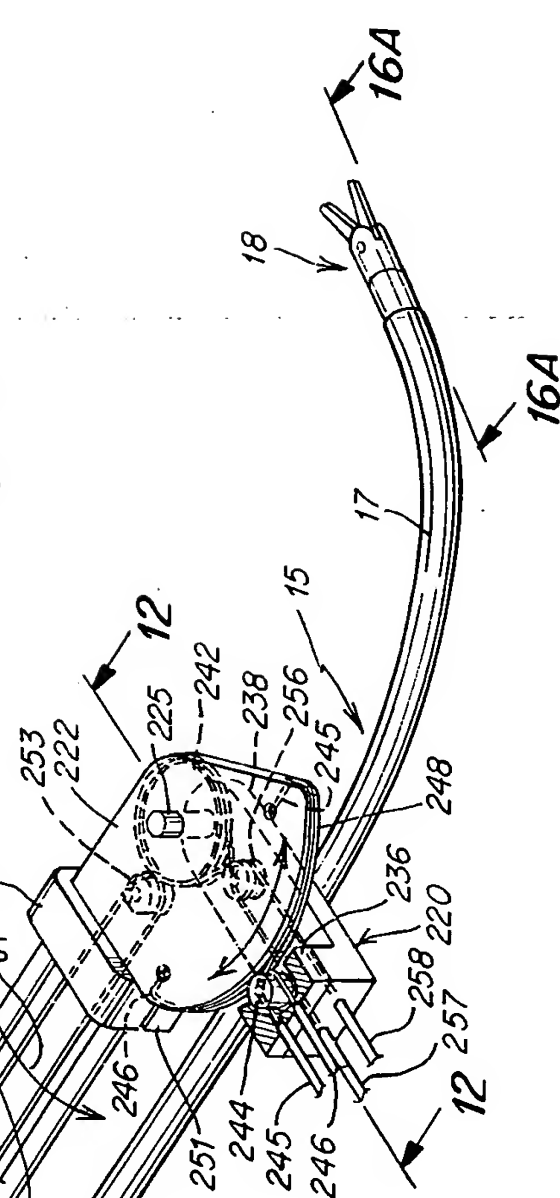


Fig. 11

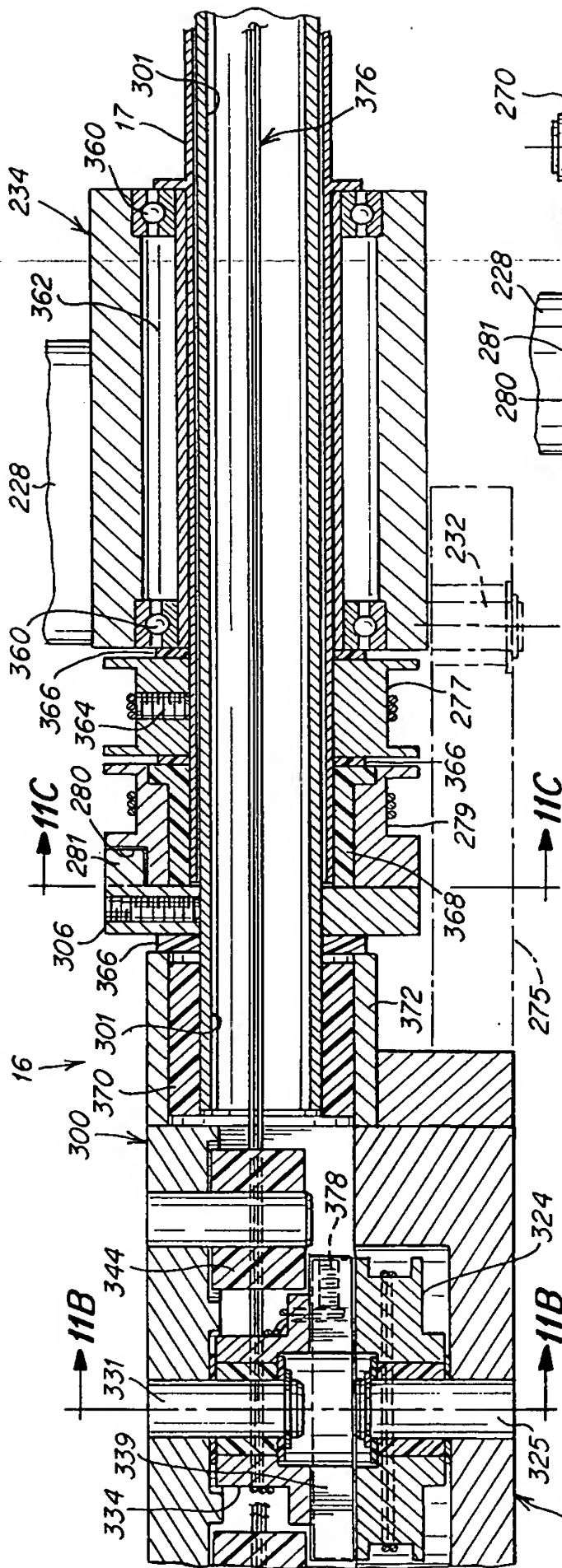


Fig. 11A

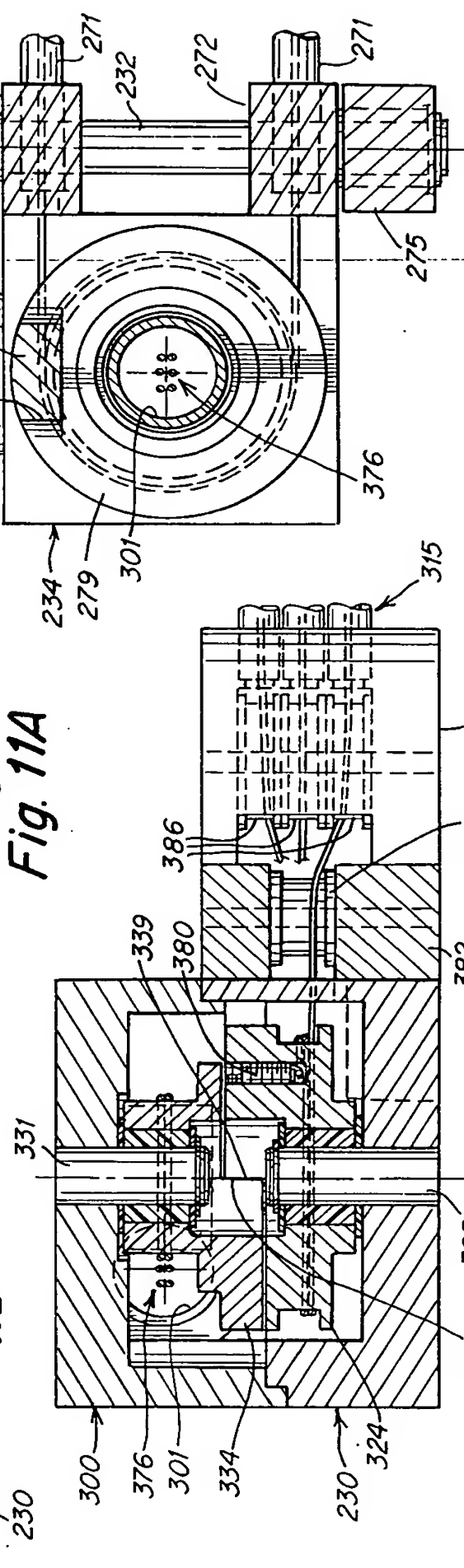
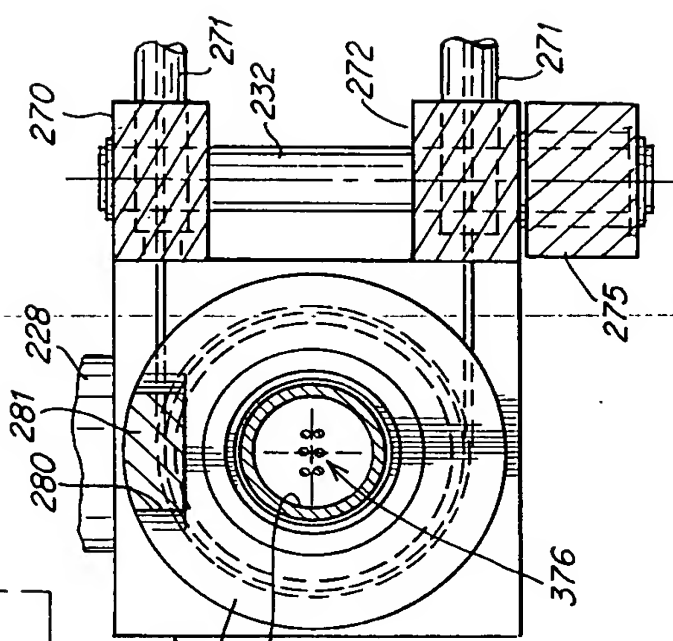
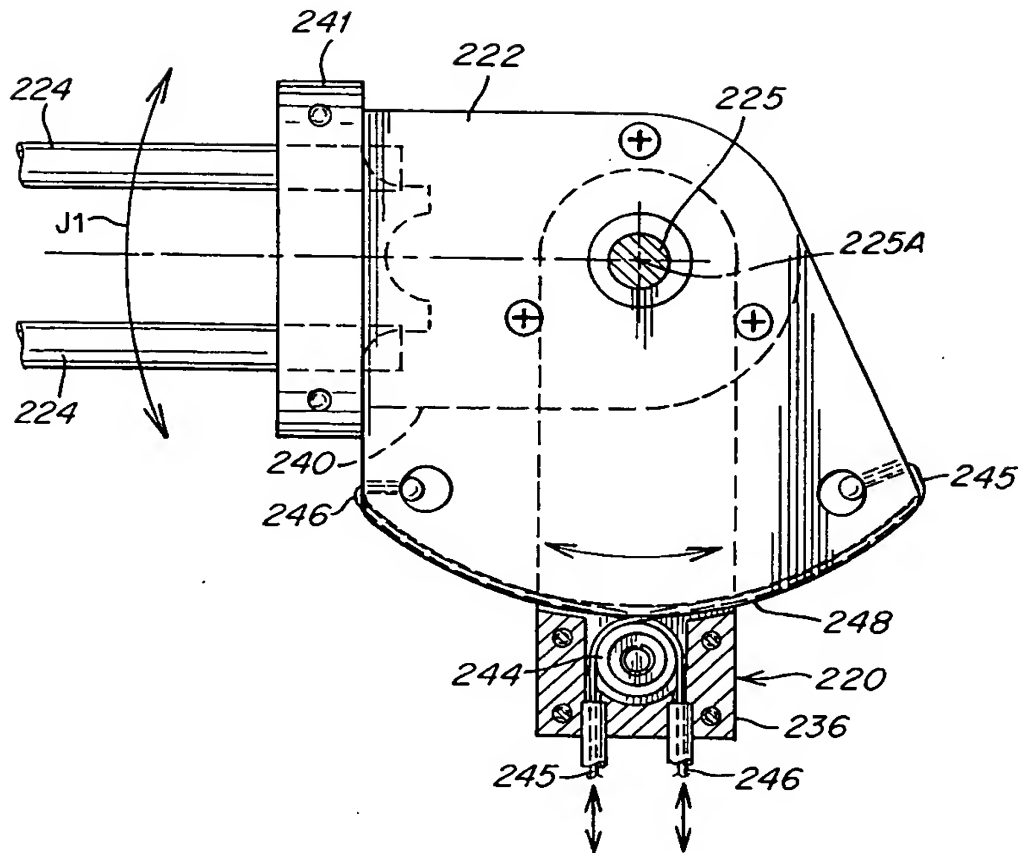


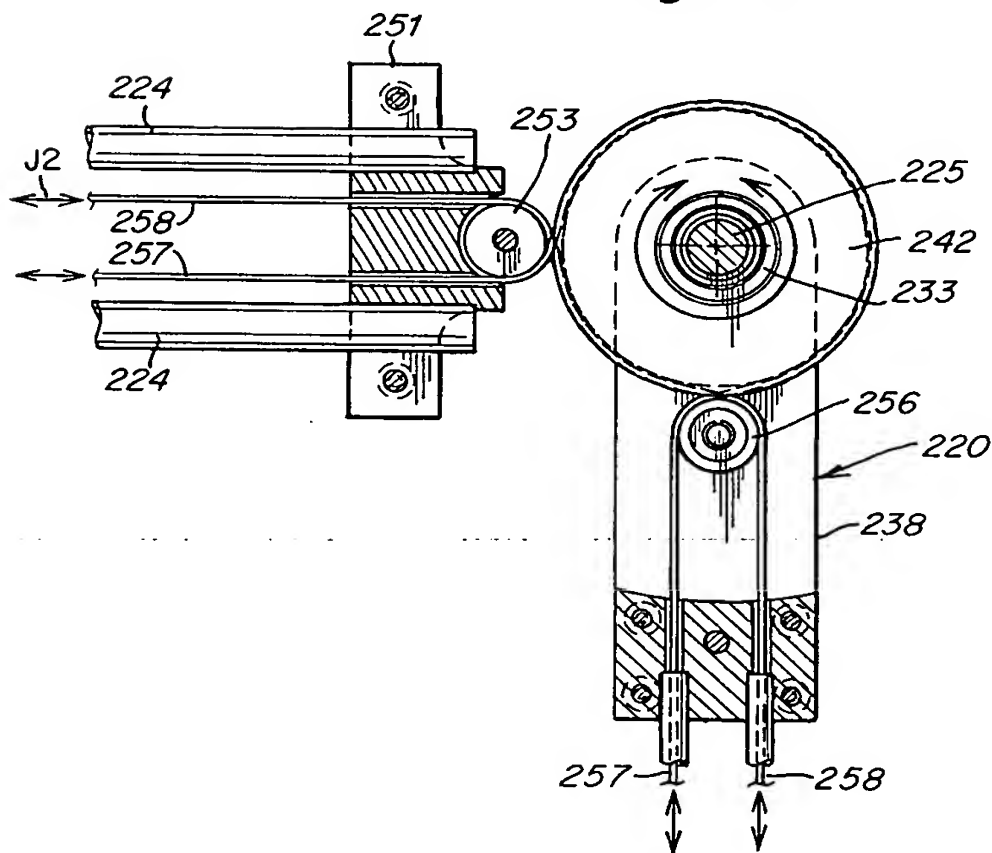
Fig. 11B

Fig. 11C





*Fig. 13*



*Fig. 14*

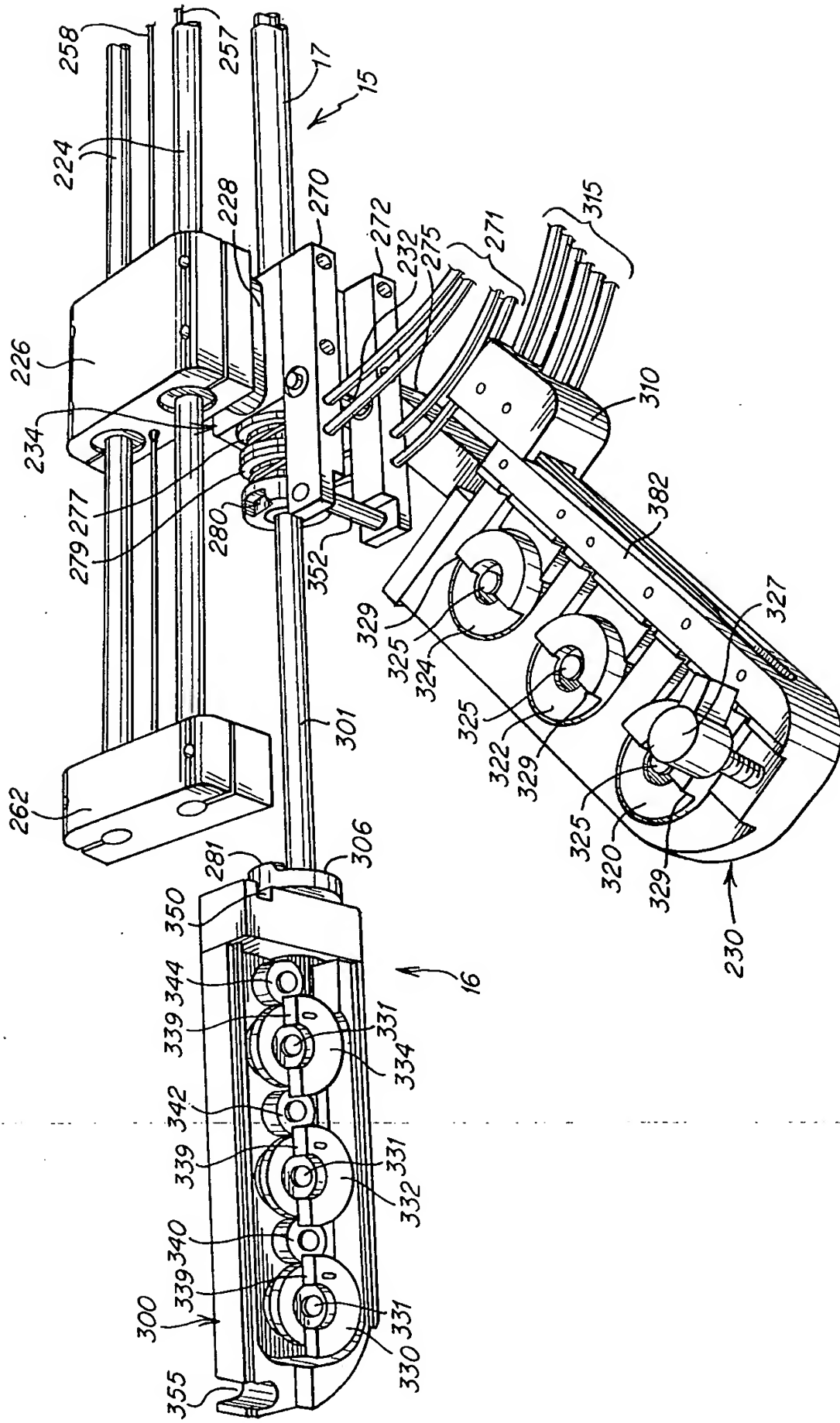


Fig. 15

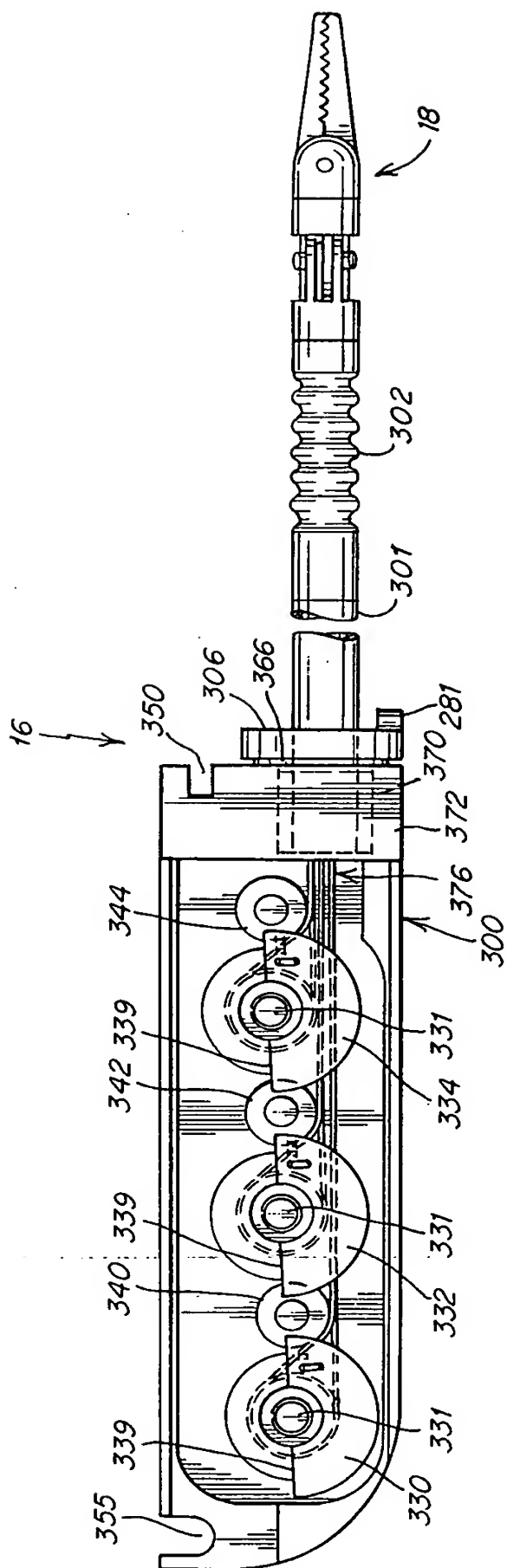
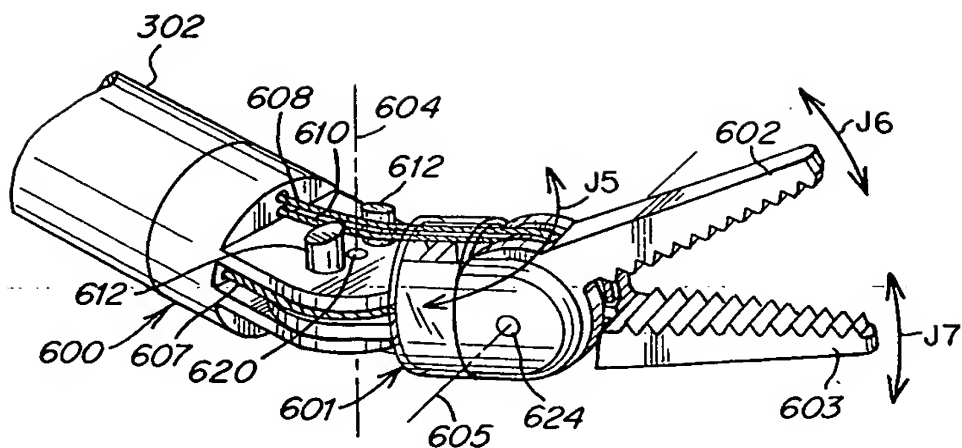
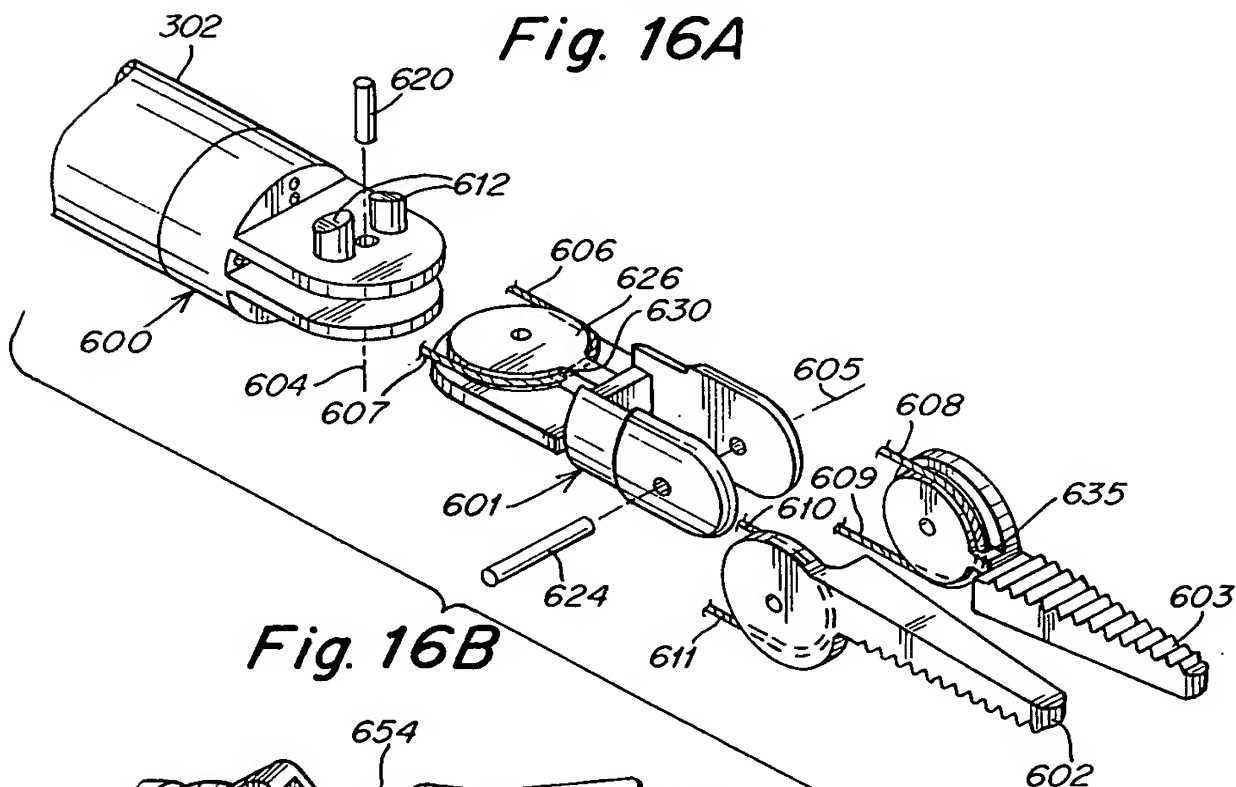


Fig. 15A

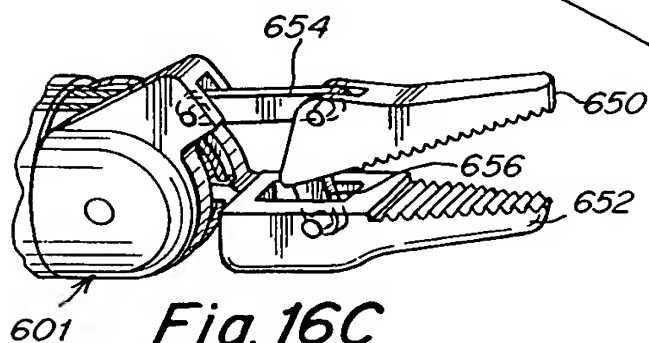




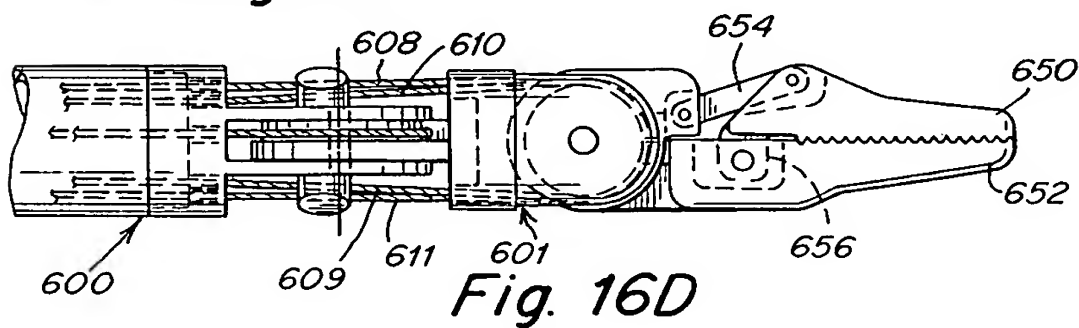
**Fig. 16A**



**Fig. 16B**

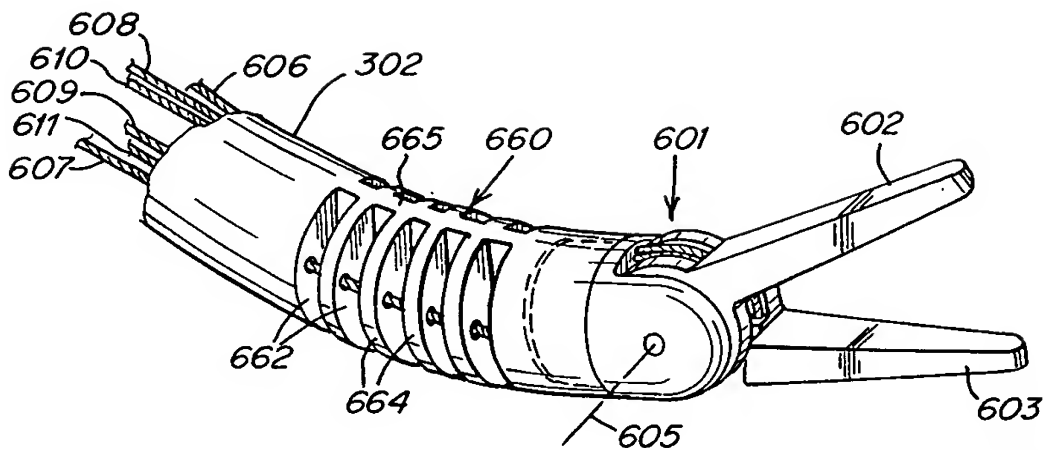


**Fig. 16C**

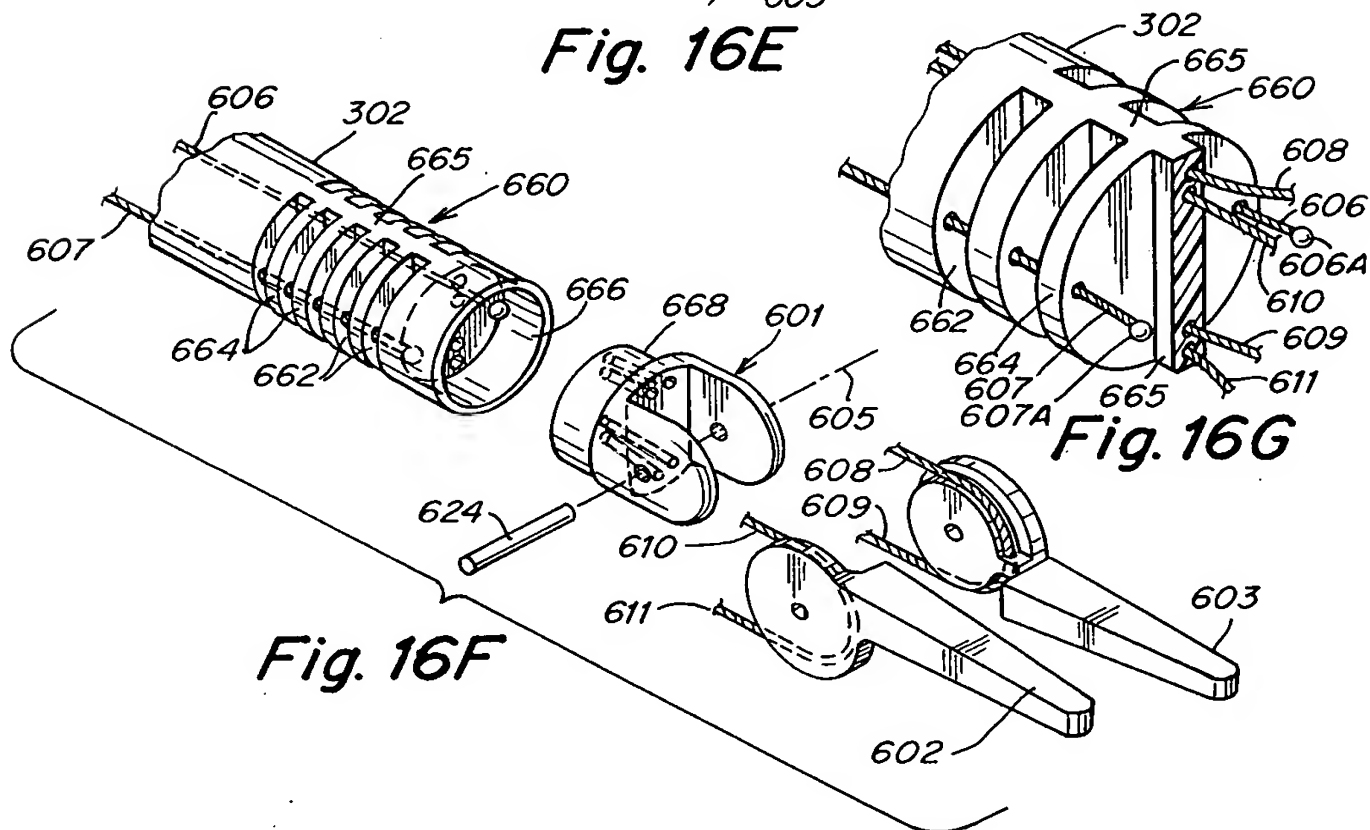


**Fig. 16D**

FIG. 16E

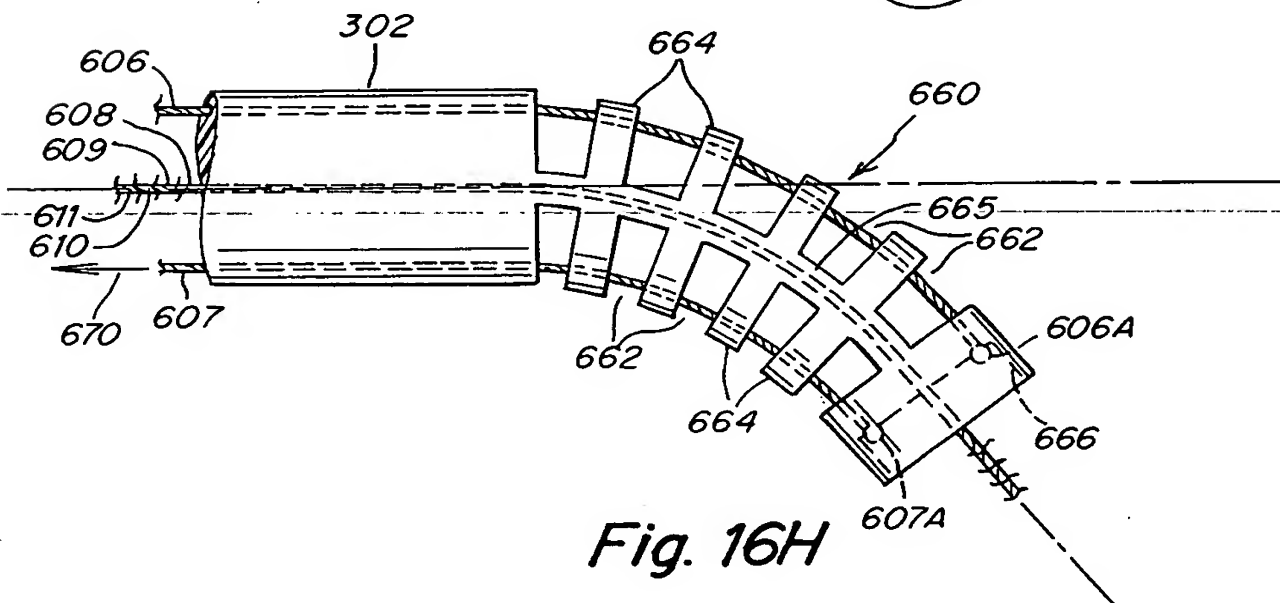


**Fig. 16E**

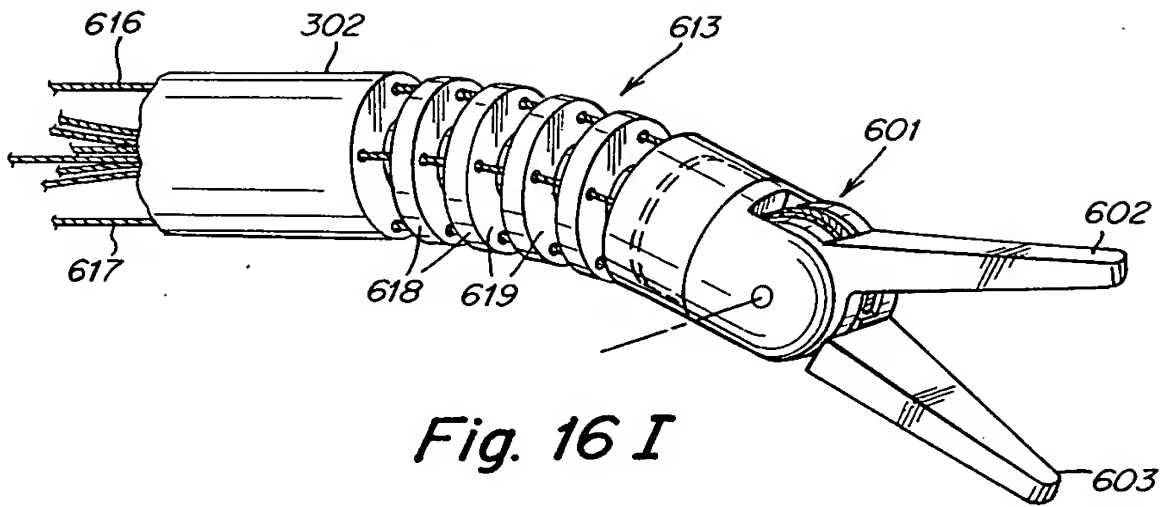


**Fig. 16F**

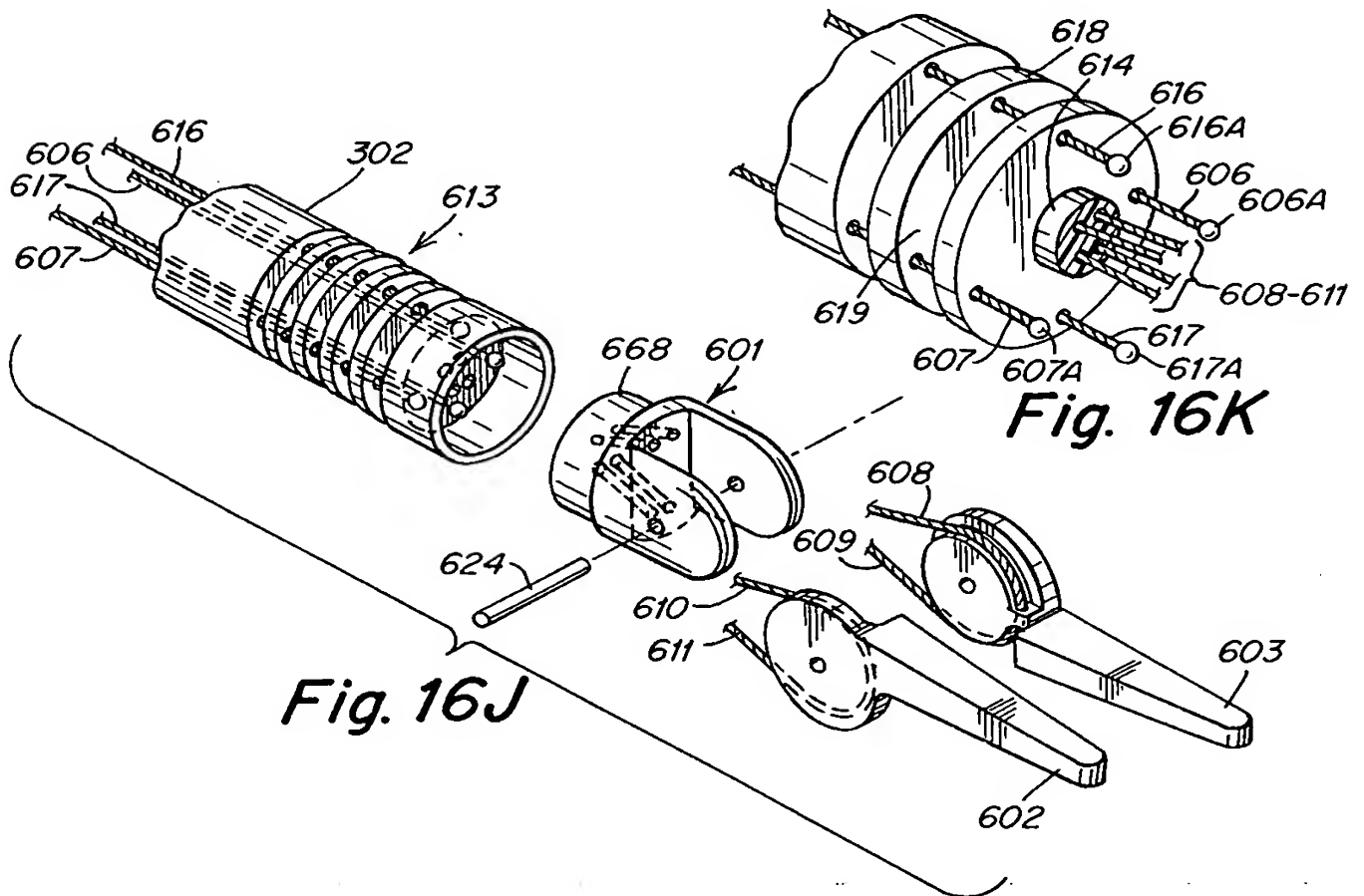
**Fig. 16G**



**Fig. 16H**



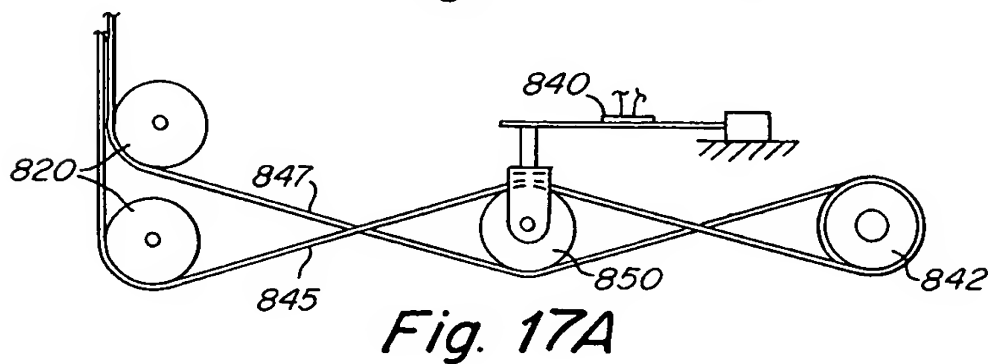
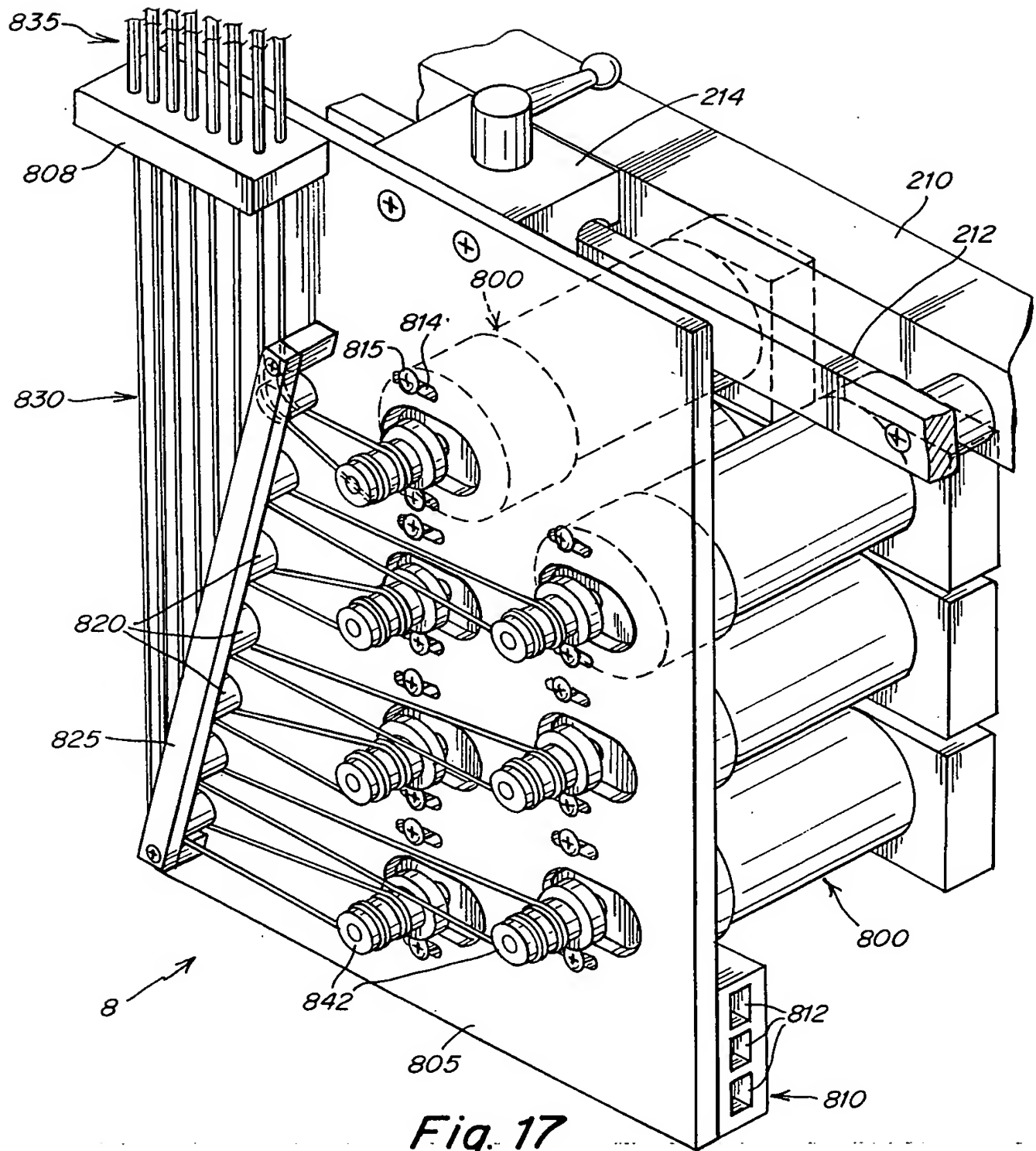
**Fig. 16 I**

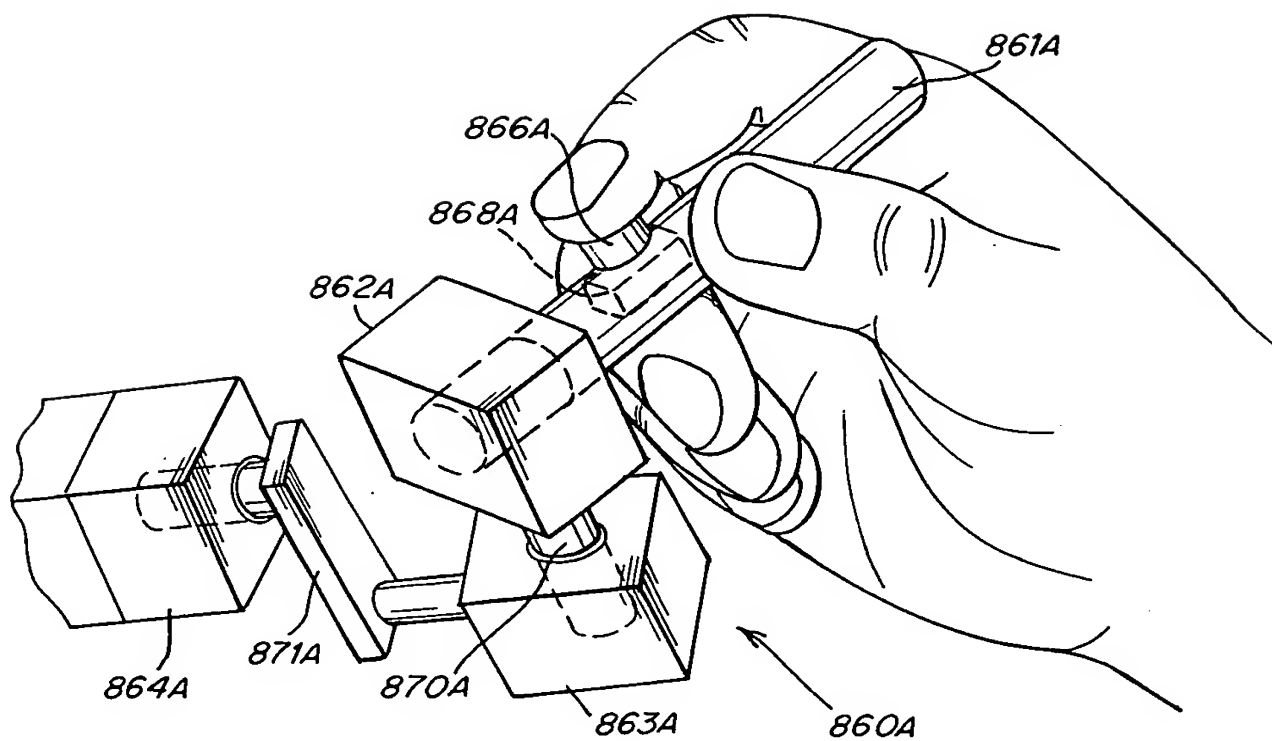


**Fig. 16K**

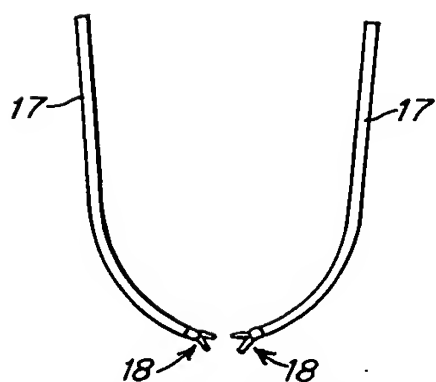
**Fig. 16J**

FIG. 16 I

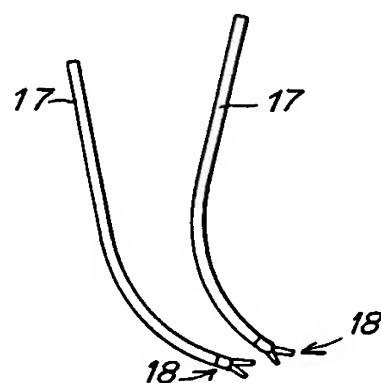




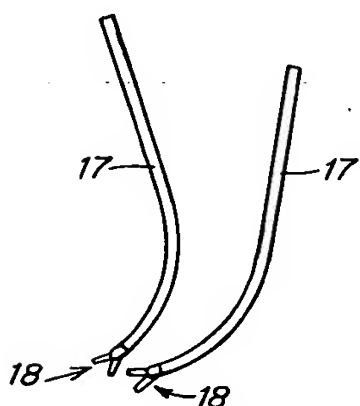
**Fig. 18**



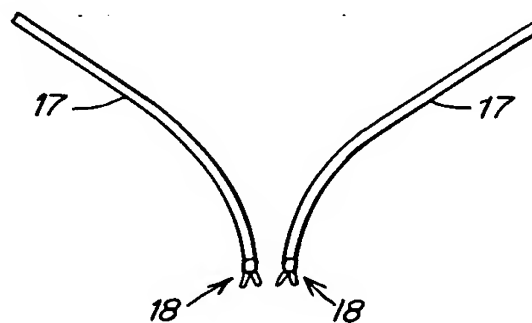
**Fig. 19 A**



**Fig. 19 B**



**Fig. 19 C**



**Fig. 19 D**

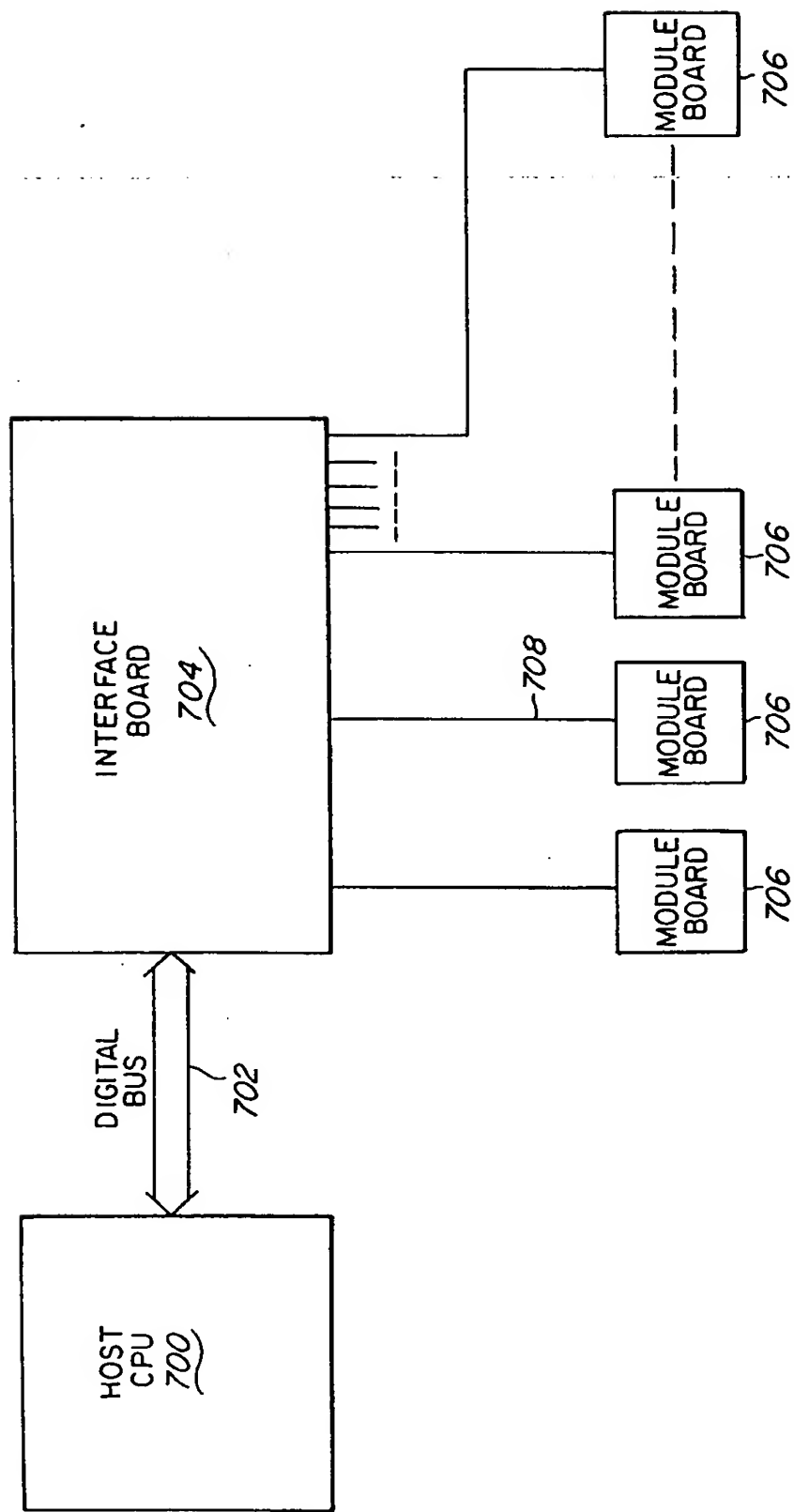


Fig. 20

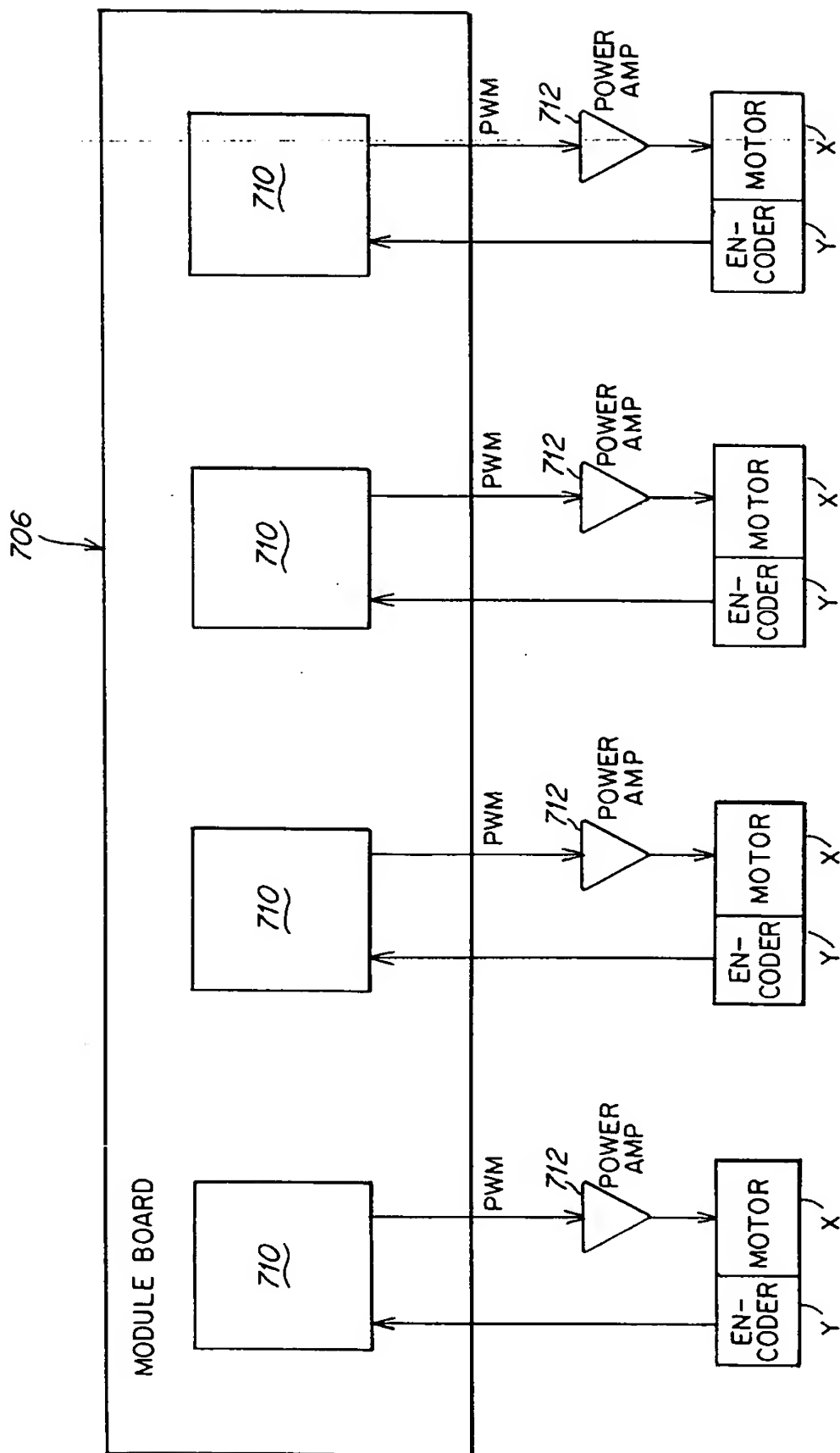


Fig. 21

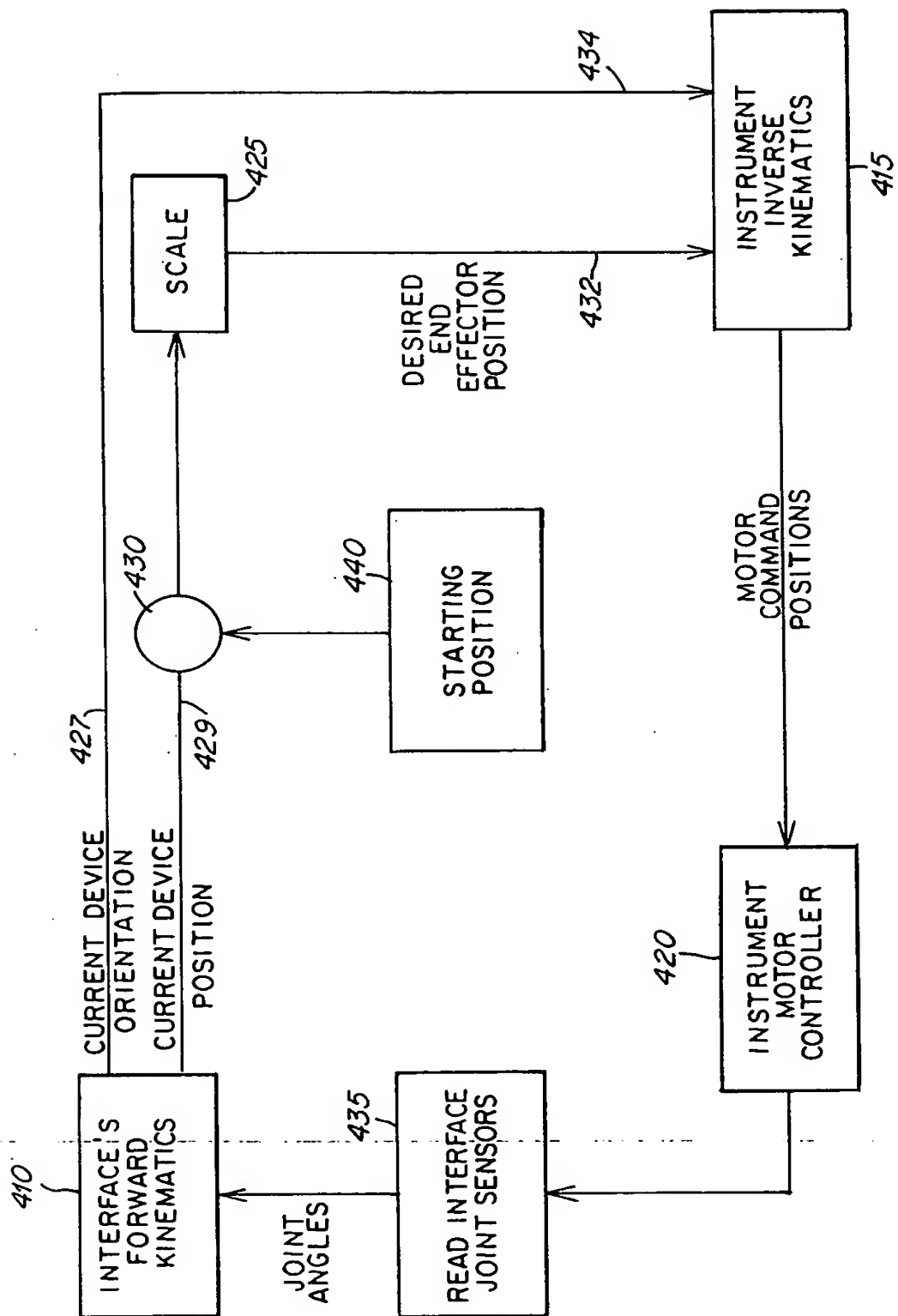
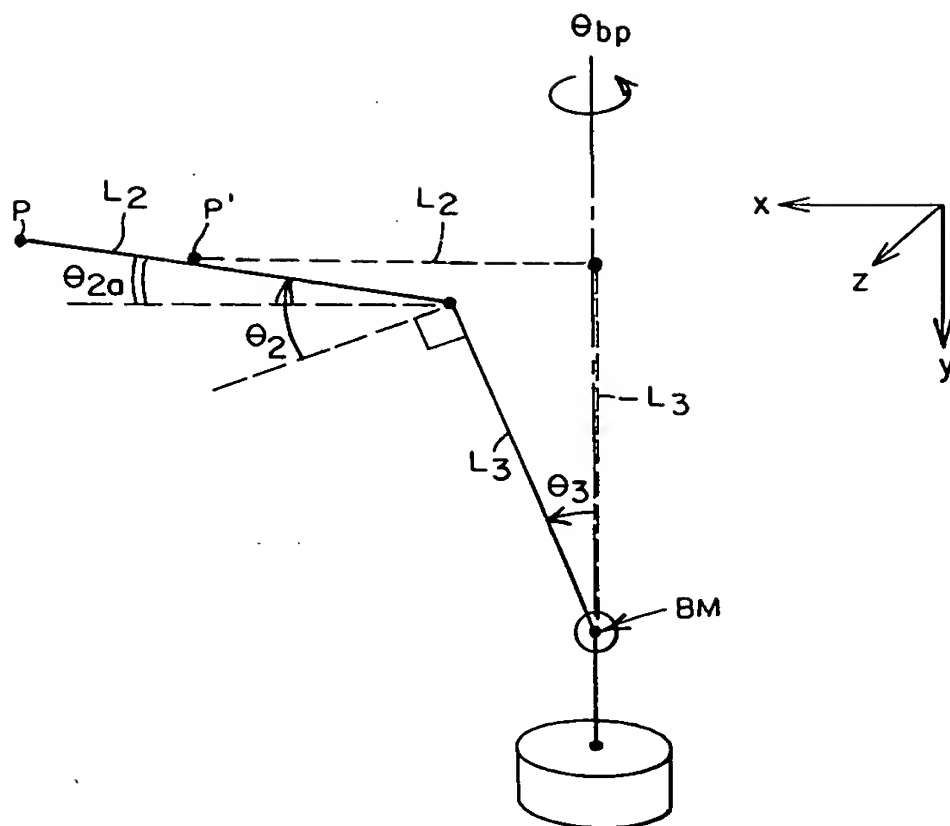


Fig. 22





*Fig. 23*

The diagram illustrates a three-link robotic arm. The base is a cylinder with a vertical axis. A first joint, labeled  $\theta_{bp}$ , is a revolute joint (indicated by a circular arrow) that rotates the entire arm assembly around the vertical axis. A second joint, labeled  $\theta_3$ , is a revolute joint (indicated by a circular arrow) that rotates the second link relative to the vertical axis. The second link is a cylinder. A third joint, labeled  $\theta_2$ , is a revolute joint (indicated by a circular arrow) that rotates the third link relative to the second link. The third link is a cylinder. A point  $P$  is marked on the third link. A fourth joint, labeled  $\theta_{ax}$ , is a revolute joint (indicated by a circular arrow) that rotates the end effector (a small cylinder) relative to the third link. The end effector has a local coordinate frame with axes  $x_h$ ,  $y_h$ , and  $z_h$ . The angle between the third link and the vertical axis is labeled  $\theta_2$ . The angle between the second link and the vertical axis is labeled  $\theta_3$ . The angle between the first link and the vertical axis is labeled  $\theta_{bp}$ . The angle between the end effector and the third link is labeled  $\theta_{ax}$ . The angle between the third link and the vertical axis is also labeled  $\theta_2$ . The angle between the second link and the vertical axis is also labeled  $\theta_3$ . The angle between the first link and the vertical axis is also labeled  $\theta_{bp}$ . The angle between the end effector and the third link is also labeled  $\theta_{ax}$ . A coordinate frame with axes  $x$ ,  $y$ , and  $z$  is shown in the top right corner.

The diagram illustrates a robotic arm with two joints. The base joint is a revolute joint (indicated by a circle) with a rotation angle  $\theta_n$  relative to a vertical dashed line. A local coordinate frame  $(x_{wh}, y_{wh}, z_{wh})$  is defined at this joint. The arm consists of two links, each represented by a cylinder. The first link has a revolute joint (indicated by a cylinder) with a rotation angle  $\theta_{ax}$  around its longitudinal axis. The second link has a revolute joint (indicated by a cylinder) with a rotation angle  $\theta_{bp}$  around its longitudinal axis. A global coordinate frame  $(x, y, z)$  is shown at the end of the arm, with the  $x$ -axis pointing left, the  $y$ -axis pointing down, and the  $z$ -axis pointing out of the page.

*Fig. 24B*

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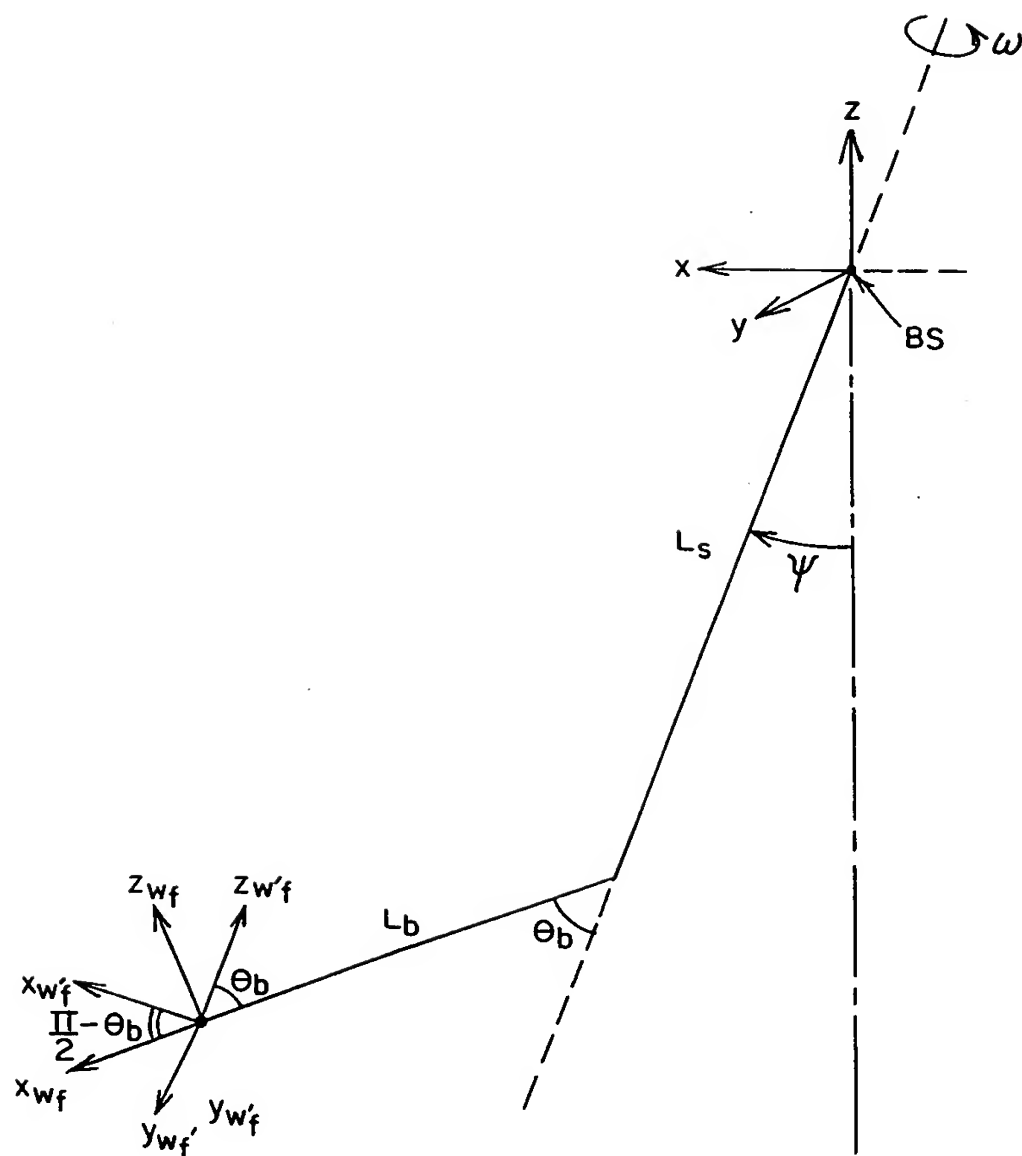
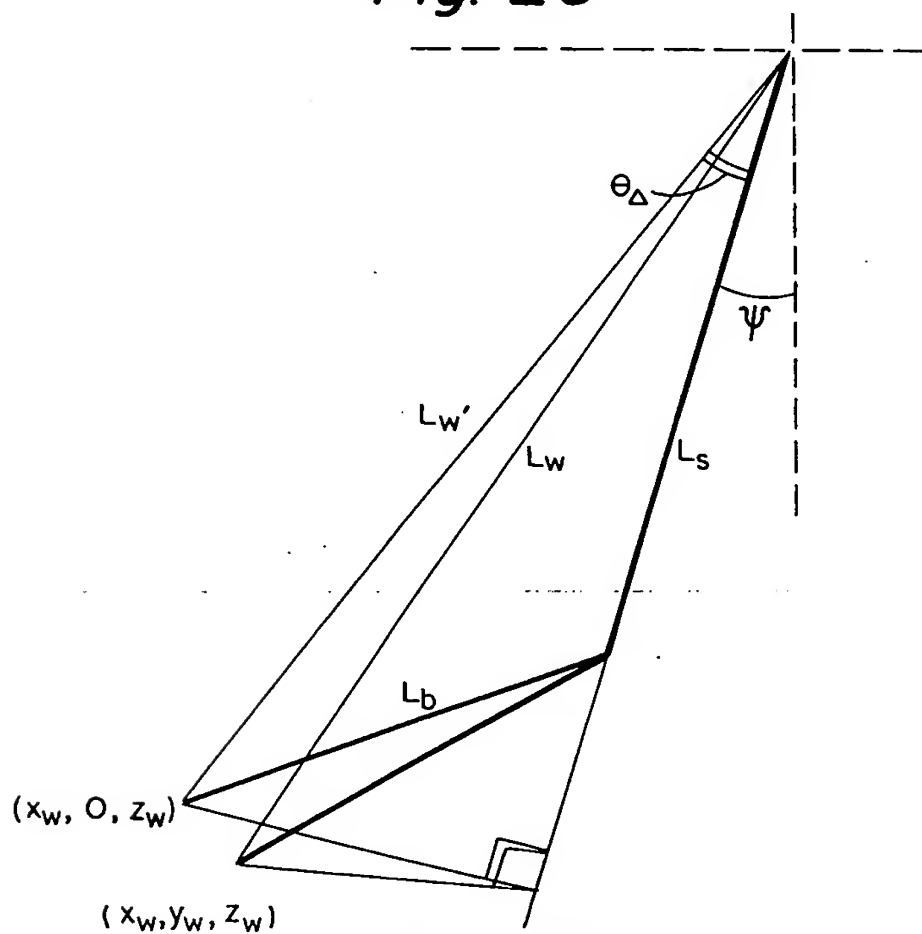
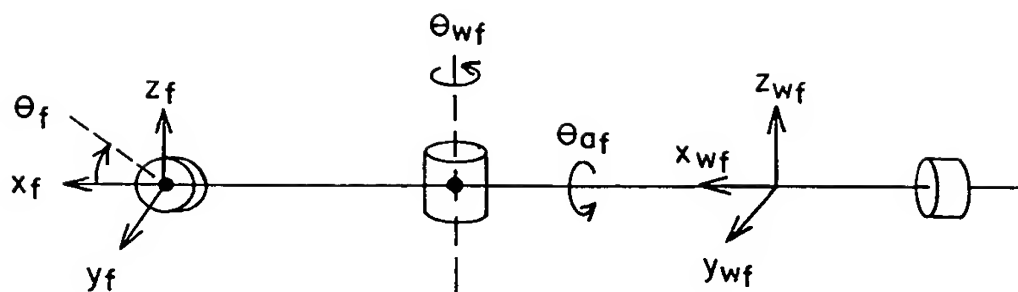


Fig. 25

*Fig. 26*



*Fig. 27*



*Fig. 28*

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